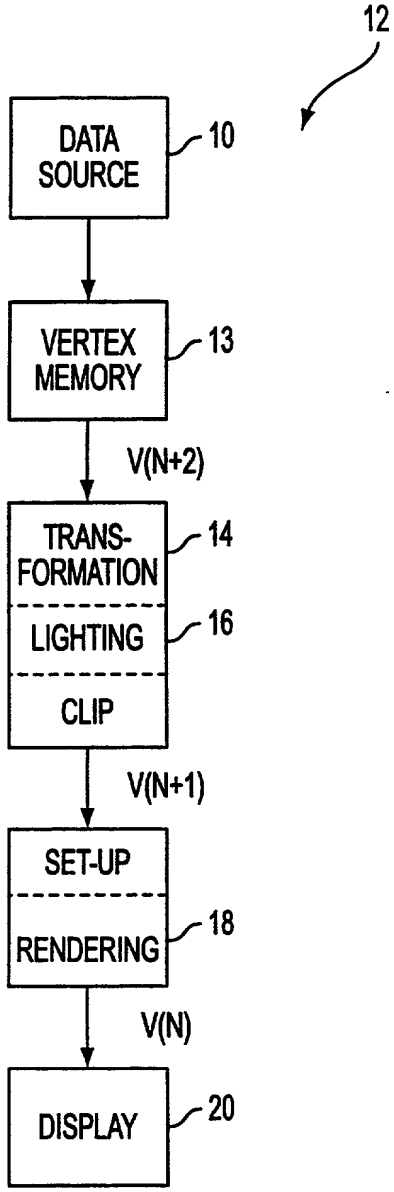


FIG. 1
(PRIOR ART)

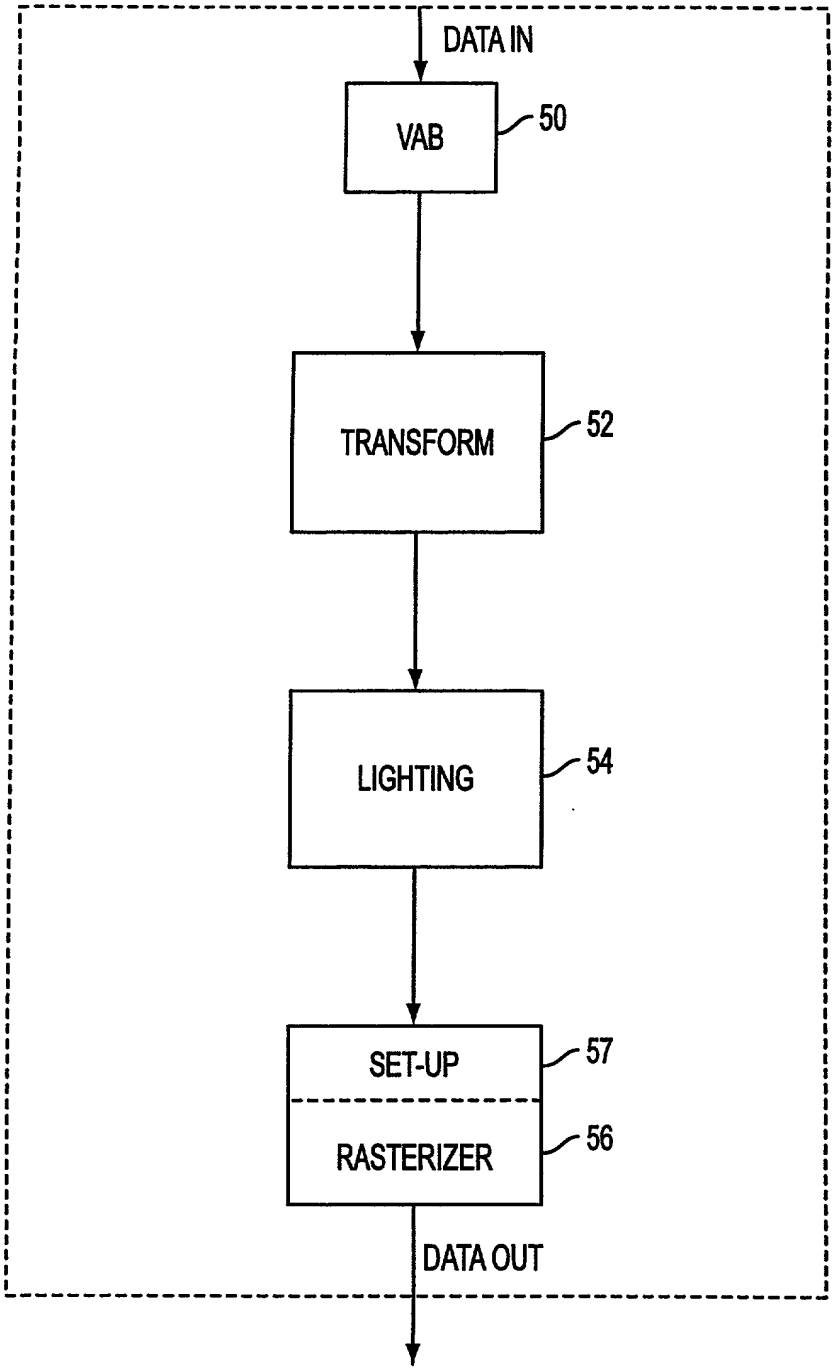
DATA IN
VAB
50
TRANSFORM
52
LIGHTING
54
SET-UP
57
RASTERIZER
56
DATA OUT

FIG. 1A

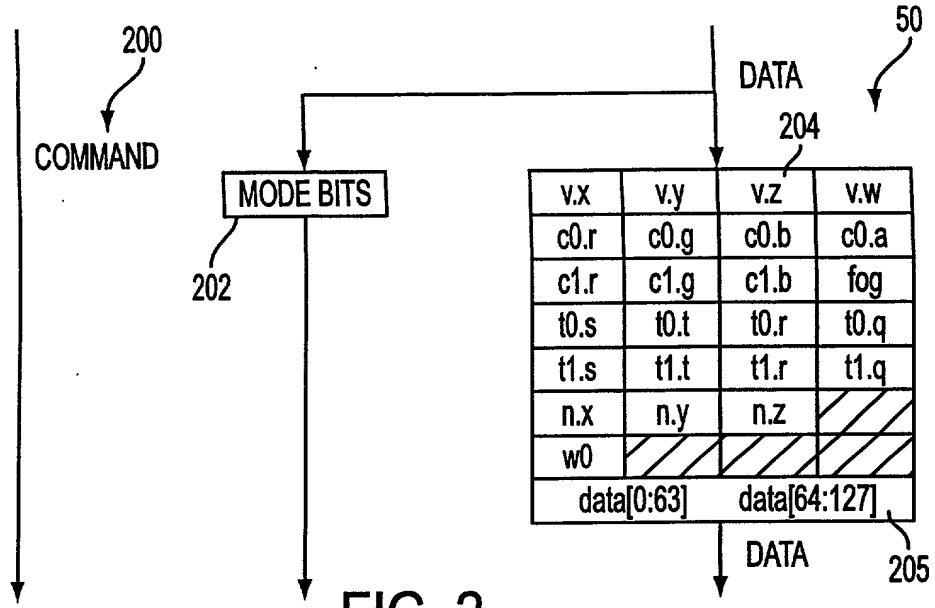


FIG. 2

| COMMAND | TRANSFORM STALL | LIGHTING STALL | DESCRIPTION |
|---|---|---|---|
| FE2XF_CMD_NOP | | | NO OPERATION. CAN BE USED AS A SPACER BETWEEN COMMANDS. |
| FE2XF_CMD_VERTEX | READ | READ | VERTEX DATA. |
| FE2XF_CMD_PASSTHR | | | PASSTHROUGH. TRANSFORM AND LIGHTING PASS THE DATA THROUGH. |
| FE2XF_CMD_RDVAB | | | READ THE VAB CONTENTS WHEN CONTEXT SWITCHING. |
| FE2XF_CMD_LDMODE | | | LOAD NEW MODE BITS. |
| FE2XF_CMD_LDXFCTX | WRITE | | LOAD TRANSFORM CONTEXT MEMORY DATA. |
| FE2XF_CMD_RDXFCTX | READ | | READ TRANSFORM CONTEXT MEMORY DATA. |
| FE2XF_CMD_LDLTCTX | | WRITE | LOAD LIGHTING CONTEXT MEMORY DATA. |
| FE2XF_CMD_RDLTCTX | | READ | READ LIGHTING CONTEXT MEMORY DATA. |
| FE2XF_CMD_LDLTC0 | | WRITE | LOAD LIGHTING CONTEXT0 MEMORY DATA. |
| FE2XF_CMD_RDLTC0 | | READ | READ LIGHTING CONTEXT0 MEMORY DATA. |
| FE2XF_CMD_LDLTC1 | | WRITE | LOAD LIGHTING CONTEXT1 MEMORY DATA. |
| FE2XF_CMD_RDLTC1 | | READ | READ LIGHTING CONTEXT1 MEMORY DATA. |
| FE2XF_CMD_LDLTC2 | | WRITE | LOAD LIGHTING CONTEXT2 MEMORY DATA. |
| FE2XF_CMD_RDLTC2 | | READ | READ LIGHTING CONTEXT2 MEMORY DATA. |
| FE2XF_CMD_LTLTC3 | | WRITE | LOAD LIGHTING CONTEXT3 MEMORY DATA. |
| FE2XF_CMD_RDLTC3 | | READ | READ LIGHTING CONTEXT3 MEMORY DATA. |
| FE2XF_CMD_SYNC | READ+ WRITE | READ+ WRITE | SIMILAR TO NOP, BUT IS NOT ALLOWED TO BE PROCESSED IN PARALLEL. |

FIG. 2A

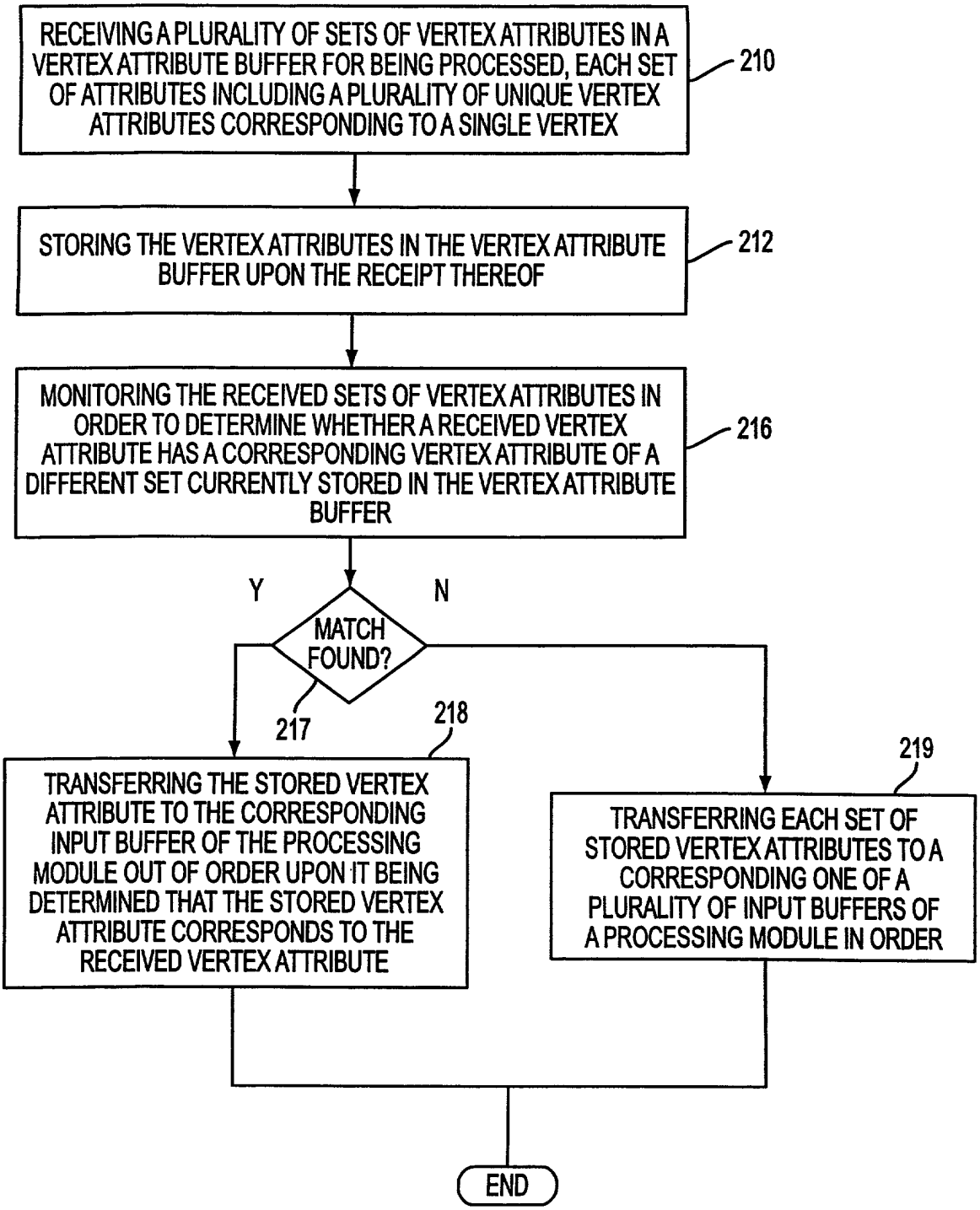
RECEIVING A PLURALITY OF SETS OF VERTEX ATTRIBUTES IN A VERTEX ATTRIBUTE BUFFER FOR BEING PROCESSED, EACH SET OF ATTRIBUTES INCLUDING A PLURALITY OF UNIQUE VERTEX ATTRIBUTES CORRESPONDING TO A SINGLE VERTEX
210
STORING THE VERTEX ATTRIBUTES IN THE VERTEX ATTRIBUTE BUFFER UPON THE RECEIPT THEREOF
212
MONITORING THE RECEIVED SETS OF VERTEX ATTRIBUTES IN ORDER TO DETERMINE WHETHER A RECEIVED VERTEX ATTRIBUTE HAS A CORRESPONDING VERTEX ATTRIBUTE OF A DIFFERENT SET CURRENTLY STORED IN THE VERTEX ATTRIBUTE BUFFER
216
Y
N
MATCH FOUND?
217
218
TRANSFERRING THE STORED VERTEX ATTRIBUTE TO THE CORRESPONDING INPUT BUFFER OF THE PROCESSING MODULE OUT OF ORDER UPON IT BEING DETERMINED THAT THE STORED VERTEX ATTRIBUTE CORRESPONDS TO THE RECEIVED VERTEX ATTRIBUTE
219
TRANSFERRING EACH SET OF STORED VERTEX ATTRIBUTES TO A CORRESPONDING ONE OF A PLURALITY OF INPUT BUFFERS OF A PROCESSING MODULE IN ORDER
END

FIG. 2B

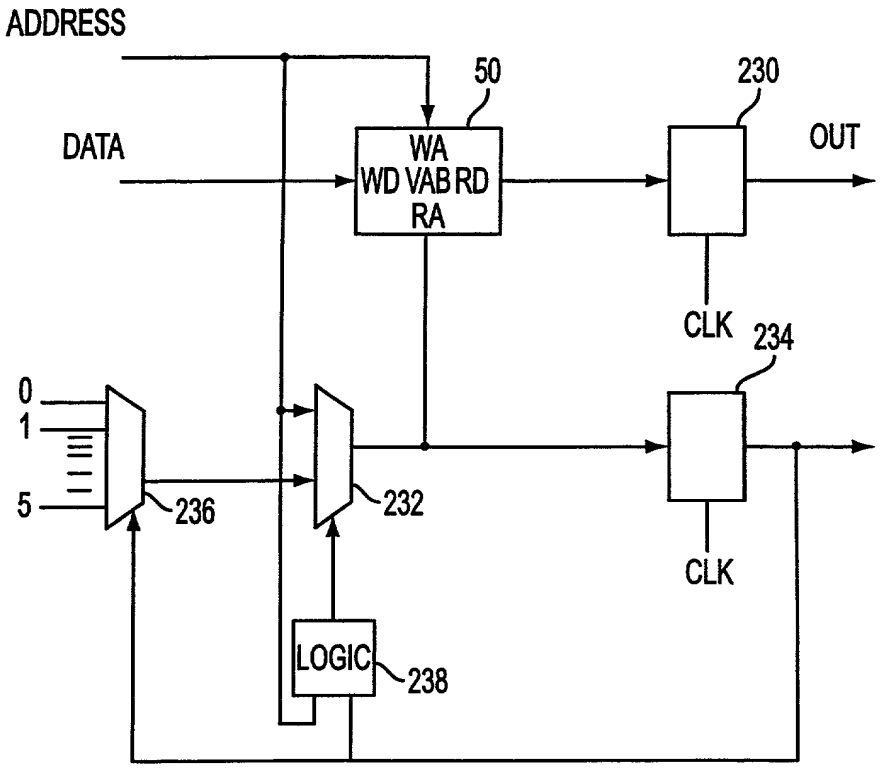
ADDRESS
50
230
DATA
WA
WD VAB RD
RA
OUT
CLK
234
0
1
5
236
232
CLK
LOGIC
238

FIG. 2C

| MODE BIT | BITS | DESCRIPTION |
|---|---|---|
| T0 | 1 | TEXTURE 0 ENABLE |
| TXF0 | 1 | TEXTURE 0 MATRIX TRANSFORM ENABLE |
| TDV0 | 1 | TEXTURE 0 w DIVIDE ENABLE |
| T0S | 3 | TEXTURE 0 TEXGEN s CONTROL |
| T0T | 3 | TEXTURE 0 TEXGEN t CONTROL |
| T0U | 3 | TEXTURE 0 TEXGEN r CONTROL |
| T0Q | 2 | TEXTURE 0 TEXGEN q CONTROL |
| T1 | 1 | TEXTURE 1 ENABLE |
| TXF1 | 1 | TEXTURE 1 MATRIX TRANSFORM ENABLE |
| TDV1 | 1 | TEXTURE 1 w DIVIDE ENABLE |
| T1S | 3 | TEXTURE 1 TEXGEN s CONTROL |
| T1T | 3 | TEXTURE 1 TEXGEN t CONTROL |
| T1U | 3 | TEXTURE 1 TEXGEN r CONTROL |
| T1Q | 2 | TEXTURE 1 TEXGEN q CONTROL |
| ETY | 1 | EYE TYPE INFINITE(0) OR LOCAL(1) |
| LIT | 1 | LIGHTING ENABLE |
| NRM | 1 | NORMAL NORMALIZE ENABLE |
| FOG | 1 | FOG ENABLE |
| LIS | 16 | LIGHT STATUS ( 8 LIGHTS BY 2 BITS EACH, 0:OFF,1:INFINITE,2:LOCAL,3:SPOTLIGHT) |
| FG | 2 | FOGGEN CONTROL(0: OFF, 1:RADIAL, 2: PLANE) |
| LAT | 1 | LIGHT ATTENUATION CONTROL (0: INVERT, 1: NO INVERT) |
| C1I | 1 | SPECULAR COLOR INPUT ENABLE |
| C1O | 1 | SPECULAR COLOR OUTPUT ENABLE |
| CM | 4 | COLOR MATERIAL CONTROL (1: EMISSIVE, 2: AMBIENT, 4: DIFFUSE, 8:SPECULAR) |
| PP | 1 | POINT PARAMETER ENABLE |
| SKIN | 1 | SKINNING ENABLE |
| VPAS | 1 | VERTEX PASS ENABLE |

FIG. 3

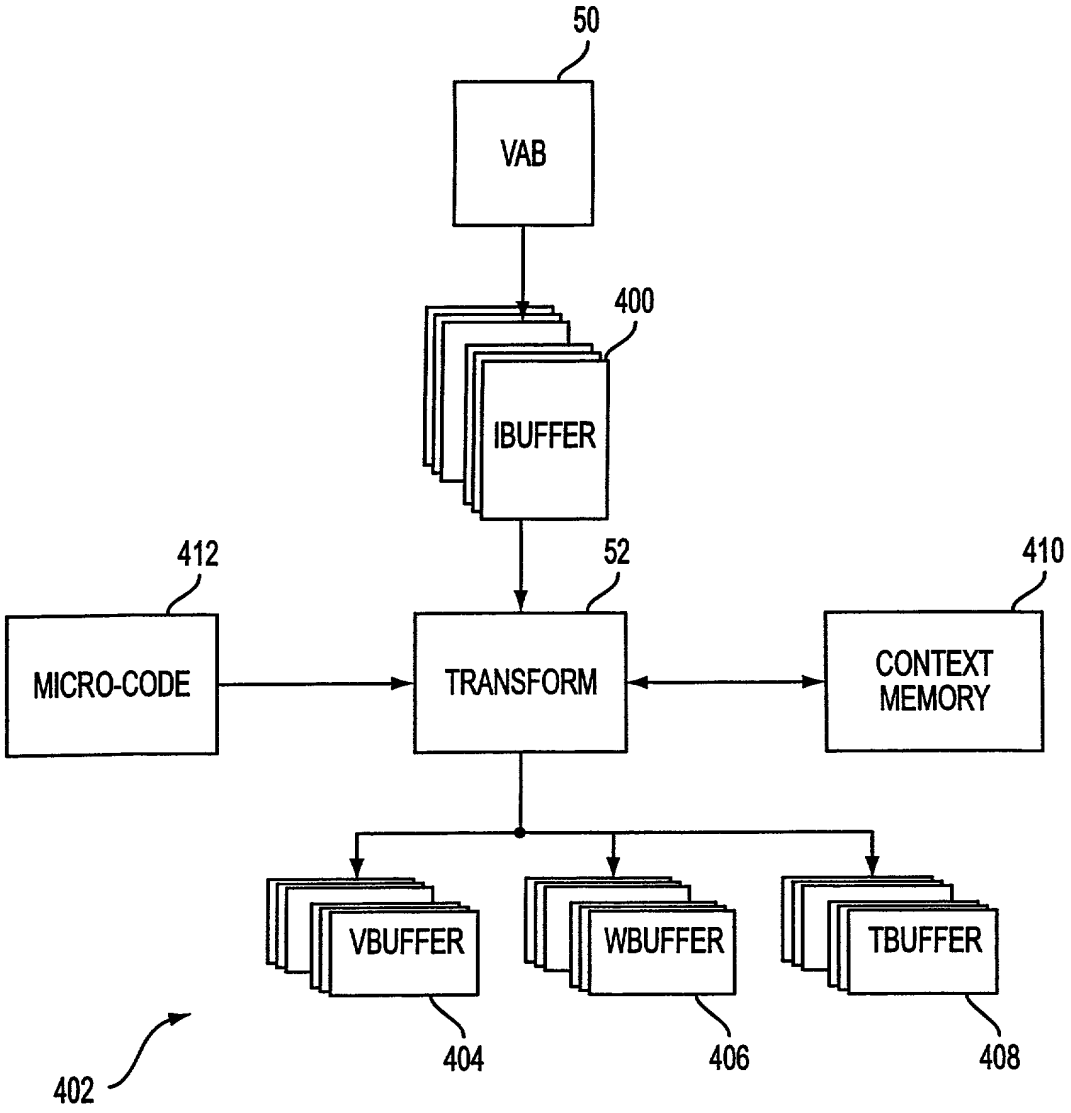
50
VAB
400
IBUFFER
412
52
410
MICRO-CODE
TRANSFORM
CONTEXT MEMORY
VBUFFER
WBUFFER
TBUFFER
404
406
408
402

FIG. 4

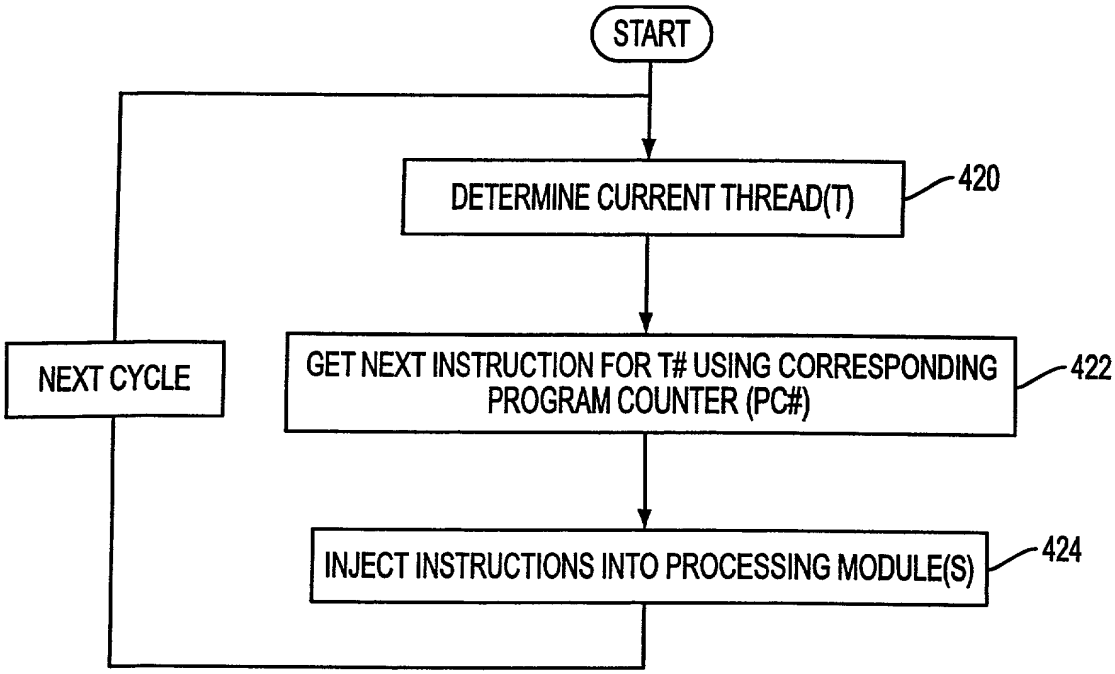
START
DETERMINE CURRENT THREAD(T)
420
GET NEXT INSTRUCTION FOR T# USING CORRESPONDING PROGRAM COUNTER (PC#)
422
INJECT INSTRUCTIONS INTO PROCESSING MODULE(S)
424
NEXT CYCLE

FIG. 4A

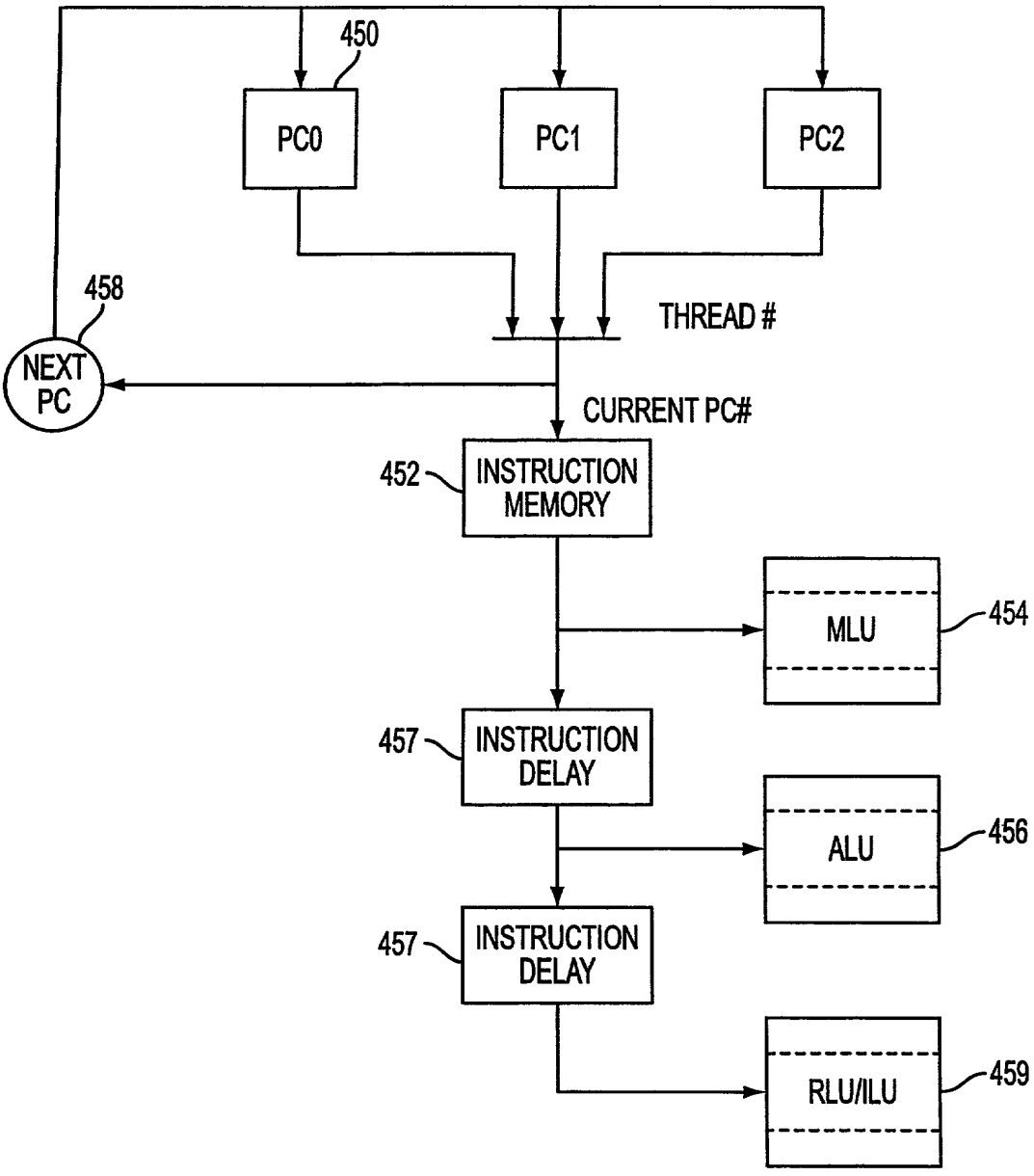
450
PC0
PC1
PC2
458
NEXT PC
THREAD #
CURRENT PC#
452
INSTRUCTION MEMORY
MLU
454
457
INSTRUCTION DELAY
ALU
456
457
INSTRUCTION DELAY
RLU/ILU
459

FIG. 4B

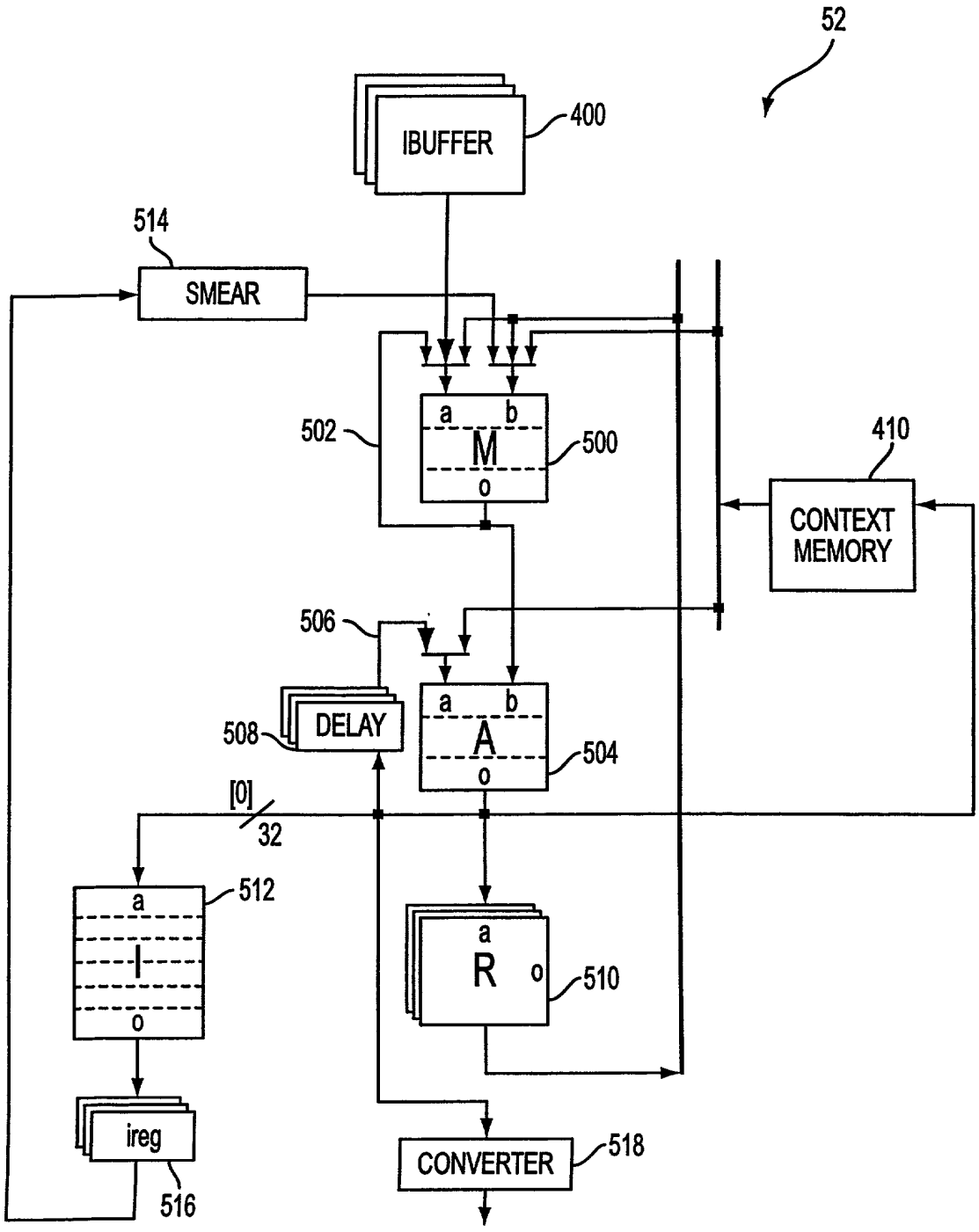
52
IBUFFER
400
514
SMEAR
502
a
b
M
o
500
410
CONTEXT MEMORY
506
DELAY
508
a
b
A
o
504
[0]
32
a
I
o
512
a
R
o
510
ireg
516
CONVERTER
518

FIG. 5

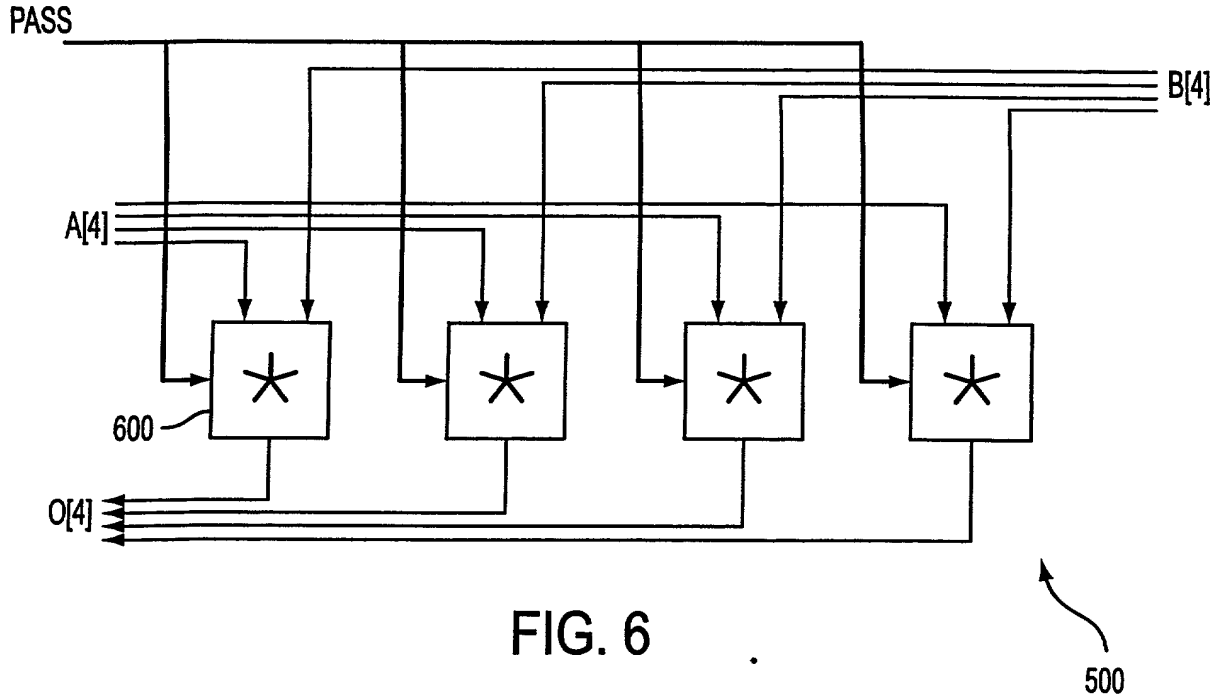
PASS
B[4]
A[4]
600
O[4]
500

FIG. 6

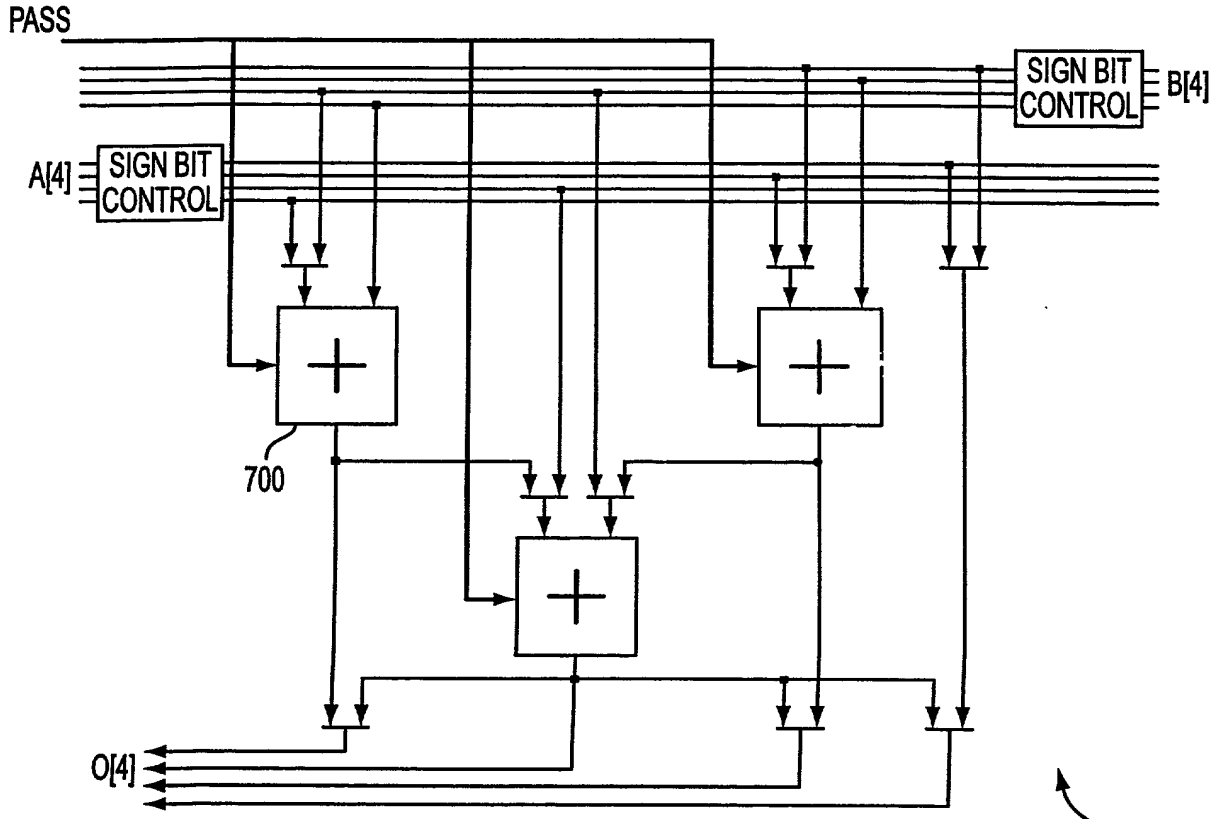
PASS
SIGN BIT CONTROL
B[4]
A[4]
SIGN BIT CONTROL
700
O[4]
504

FIG. 7

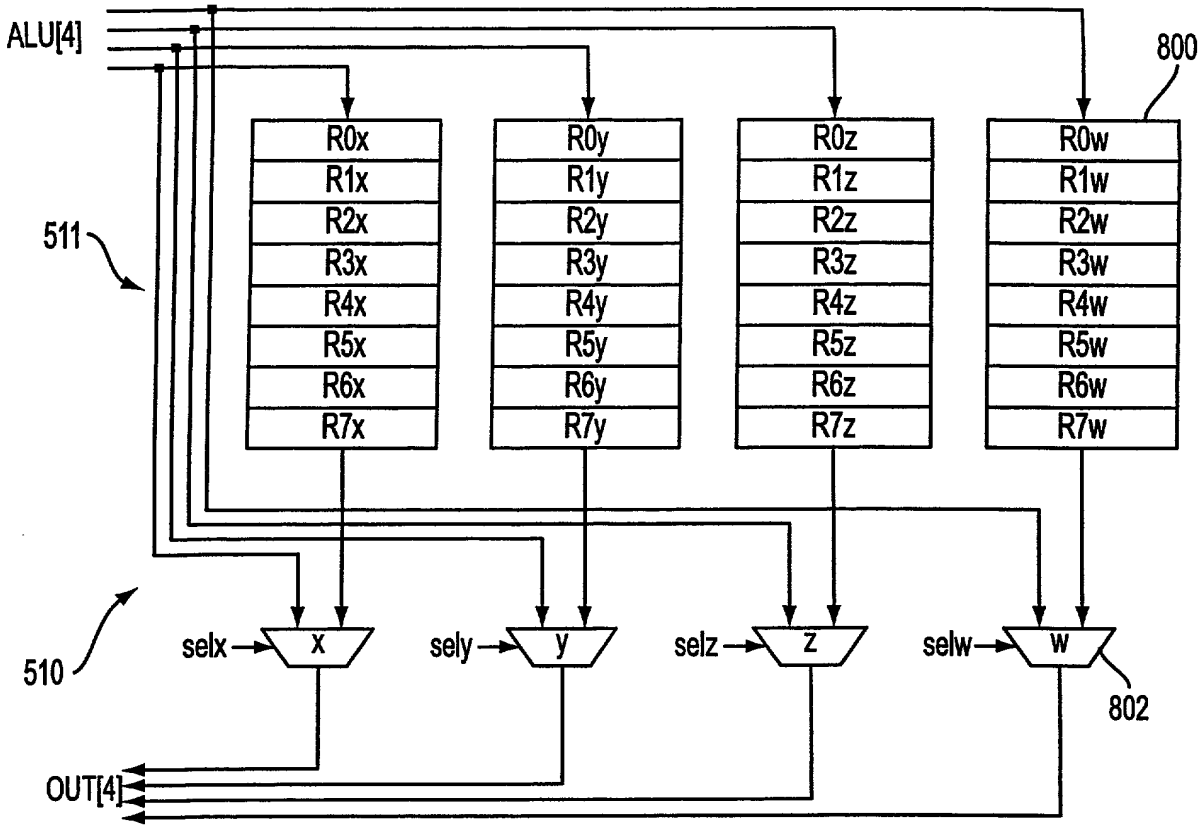
ALU[4]
800
R0x
R1x
R2x
R3x
R4x
R5x
R6x
R7x
R0y
R1y
R2y
R3y
R4y
R5y
R6y
R7y
R0z
R1z
R2z
R3z
R4z
R5z
R6z
R7z
R0w
R1w
R2w
R3w
R4w
R5w
R6w
R7w
511
510
selx
x
sely
y
selz
z
selw
w
802
OUT[4]

FIG. 8

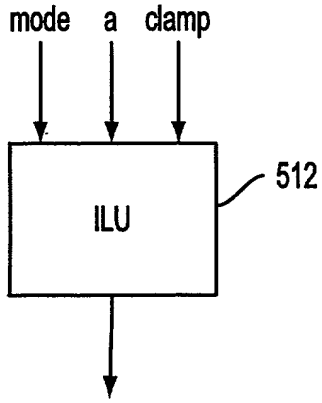
mode
a
clamp
ILU
512

FIG. 9

| ADDRESS | TARGET | ACTION | DESCRIPTION |
|---|---|---|---|
| TPOS | TBUFFER | T[0] = ALU | POSITION |
| TT0 | TBUFFER | T[3] = ALU | TEXTURE0 |
| TT1 | TBUFFER | T[4] = ALU | TEXTURE1 |
| WEV | WBUFFER,VBUFFER | W[0] = ALU, V[0].y = ALU.w | EYE VECTOR |
| WLV0 | WBUFFER,VBUFFER | W[1] = ALU, V[1].y = ALU.w | LIGHT0 DIRECTION VECTOR |
| WLV1 | WBUFFER,VBUFFER | W[2] = ALU, V[2].y = ALU.w | LIGHT1 DIRECTION VECTOR |
| WLV2 | WBUFFER,VBUFFER | W[3] = ALU, V[3].y = ALU.w | LIGHT2 DIRECTION VECTOR |
| WLV3 | WBUFFER,VBUFFER | W[4] = ALU, V[4].y = ALU.w | LIGHT3 DIRECTION VECTOR |
| WLV4 | WBUFFER,VBUFFER | W[5] = ALU, V[5].y = ALU.w | LIGHT4 DIRECTION VECTOR |
| WLV5 | WBUFFER,VBUFFER | W[6] = ALU, V[6].y = ALU.w | LIGHT5 DIRECTION VECTOR |
| WLV6 | WBUFFER,VBUFFER | W[7] = ALU, V[7].y = ALU.w | LIGHT6 DIRECTION VECTOR |
| WLV7 | WBUFFER,VBUFFER | W[8] = ALU, V[8].y = ALU.w | LIGHT7 DIRECTION VECTOR |
| WSL0 | WBUFFER | W[9] = ALU | SPOTLIGHT0 cos |
| WSL1 | WBUFFER | W[10] = ALU | SPOTLIGHT1 cos |
| WSL2 | WBUFFER | W[11] = ALU | SPOTLIGHT2 cos |
| WSL3 | WBUFFER | W[12] = ALU | SPOTLIGHT3 cos |
| WSL4 | WBUFFER | W[13] = ALU | SPOTLIGHT4 cos |
| WSL5 | WBUFFER | W[14] = ALU | SPOTLIGHT5 cos |
| WSL6 | WBUFFER | W[15] = ALU | SPOTLIGHT6 cos |
| WSL7 | WBUFFER | W[16] = ALU | SPOTLIGHT7 cos |
| VED | VBUFFER | V[0].x = 1.0, V[0].z = ALU.w | EYE RADIAL DISTANCE VECTOR |
| VLD0 | VBUFFER | V[1].x = 1.0, V[1].z = ALU.w | LIGHT0 DISTANCE VECTOR |
| VLD1 | VBUFFER | V[2].x = 1.0, V[2].z = ALU.w | LIGHT1 DISTANCE VECTOR |
| VLD2 | VBUFFER | V[3].x = 1.0, V[3].z = ALU.w | LIGHT2 DISTANCE VECTOR |
| VLD3 | VBUFFER | V[4].x = 1.0, V[4].z = ALU.w | LIGHT3 DISTANCE VECTOR |
| VLD4 | VBUFFER | V[5].x = 1.0, V[5].z = ALU.w | LIGHT4 DISTANCE VECTOR |
| VLD5 | VBUFFER | V[6].x = 1.0, V[6].z = ALU.w | LIGHT5 DISTANCE VECTOR |
| VLD6 | VBUFFER | V[7].x = 1.0, V[7].z = ALU.w | LIGHT6 DISTANCE VECTOR |
| VLD7 | VBUFFER | V[8].x = 1.0, V[8].z = ALU.w | LIGHT7 DISTANCE VECTOR |
| VC0 | VBUFFER,TBUFFER | V[9] = ALU, T[1] = ALU | DIFFUSE COLOR |
| VC1 | VBUFFER,TBUFFER | V[10] = ALU, T[2] = ALU | SPECULAR COLOR |
| VNRM | VBUFFER | V[11] = ALU | NORMAL VECTOR |
| VED2 | VBUFFER | V[12] = ALU | EYE PLANAR DISTANCE VECTOR |
| TVW_NOP | | | NO VALID OUTPUT. |

FIG. 10

| MICROCODE FIELD | BITS | LOCATION | DELAY | DESCRIPTION |
|---|---|---|---|---|
| oa | 6 | 0: 5 | 2 | OUTPUT BUFFER WRITE ADDRESS |
| rra | 3 | 6: 8 | 0 | RLU READ ADDRESS |
| rwm | 4 | 9:12 | 2 | RLU WRITE MASK |
| rwa | 3 | 13:15 | 2 | RLU WRITE ADDRESS |
| ilu | 2 | 16:17 | 2 | ILU OPERATION |
| alu | 4 | 18:21 | 1 | ALU OPERATION |
| ais | 2 | 22:23 | 1 | ALU SIGN CONTROL |
| aia | 1 | 24 | 1 | ALU INPUT A MUX |
| mlu | 3 | 25:27 | 0 | MLU OPERATION |
| mib | 2 | 28:29 | 0 | MLU INPUT B MUX |
| mia | 2 | 30:31 | 0 | MLU INPUT A MUX |
| va | 3 | 32:34 | 0 | INPUT BUFFER READ ADDRESS |
| ce | 1 | 35 | 0,2 | CONTEXT MEMORY READ/WRITE |
| ca | 6 | 36:41 | 0,2 | CONTEXT MEMORY ADDRESS |
| mr | 2 | 42:43 | 0 | MLU INPUT VECTOR ROTATE |

FIG. 11

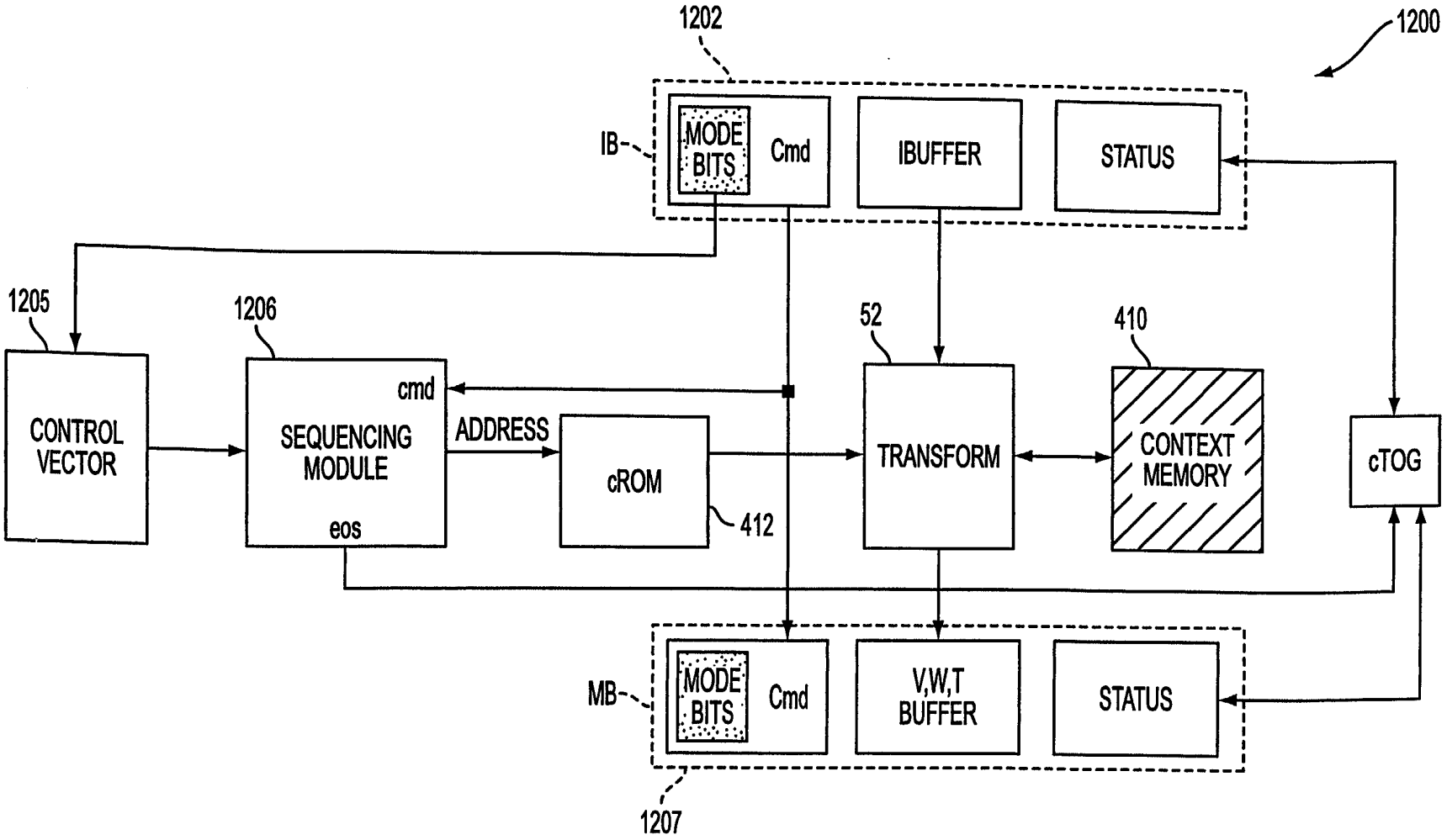
1202
1200
IB
MODE BITS
Cmd
IBUFFER
STATUS
1205
1206
52
410
CONTROL VECTOR
cmd
SEQUENCING MODULE
eos
ADDRESS
cROM
412
TRANSFORM
CONTEXT MEMORY
cTOG
MB
MODE BITS
Cmd
V,W,T BUFFER
STATUS
1207

FIG. 12

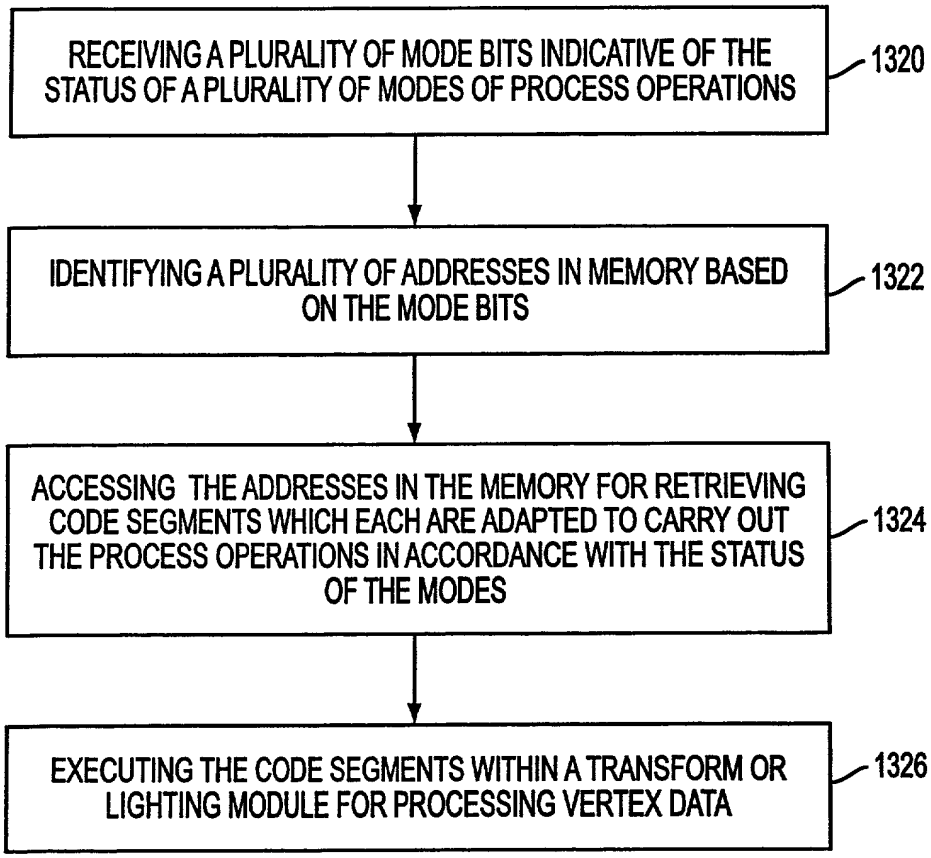
RECEIVING A PLURALITY OF MODE BITS INDICATIVE OF THE STATUS OF A PLURALITY OF MODES OF PROCESS OPERATIONS
1320
IDENTIFYING A PLURALITY OF ADDRESSES IN MEMORY BASED ON THE MODE BITS
1322
ACCESSING THE ADDRESSES IN THE MEMORY FOR RETRIEVING CODE SEGMENTS WHICH EACH ARE ADAPTED TO CARRY OUT THE PROCESS OPERATIONS IN ACCORDANCE WITH THE STATUS OF THE MODES
1324
EXECUTING THE CODE SEGMENTS WITHIN A TRANSFORM OR LIGHTING MODULE FOR PROCESSING VERTEX DATA
1326

FIG. 13

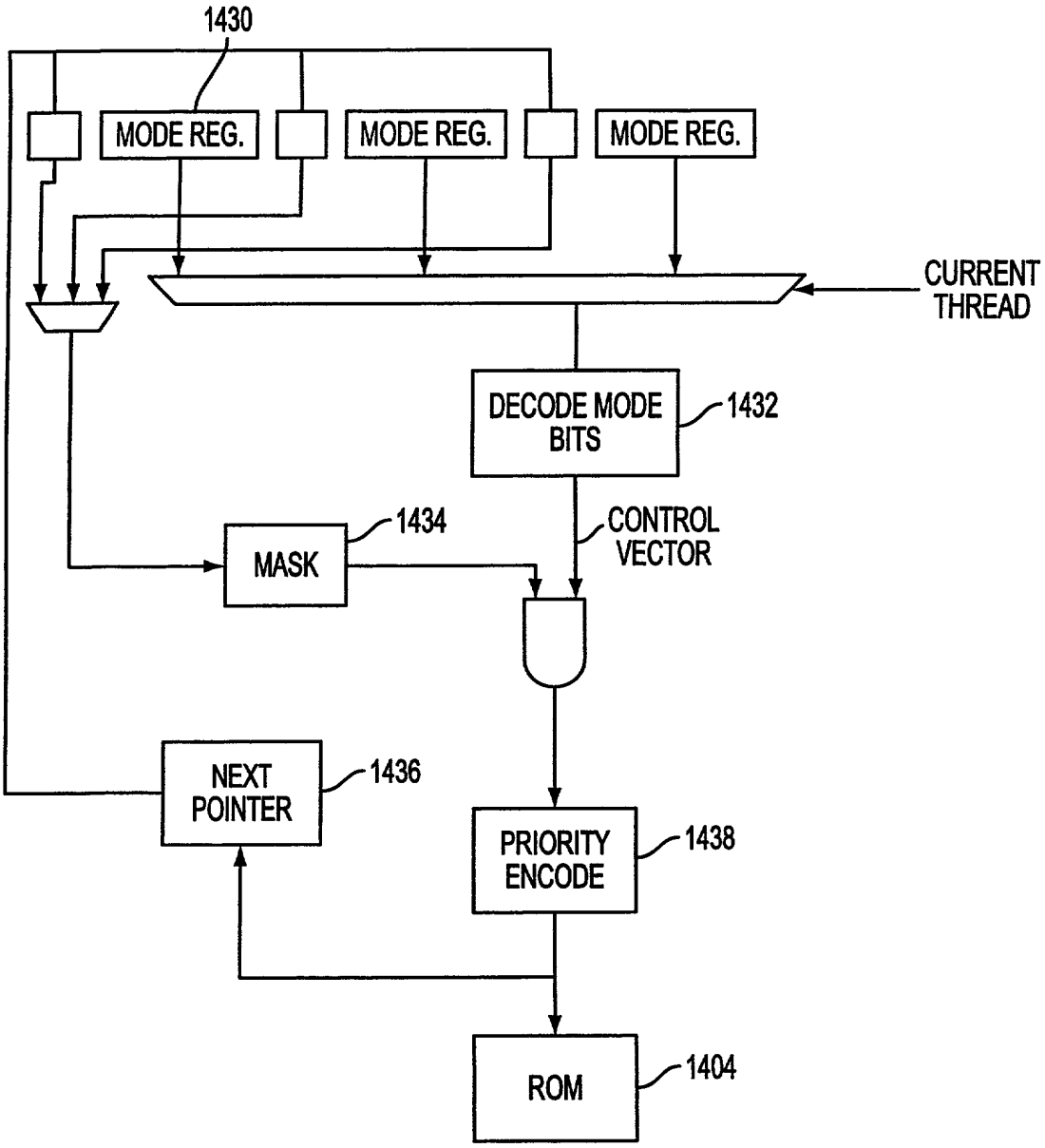
1430
MODE REG.
MODE REG.
MODE REG.
CURRENT THREAD
DECODE MODE BITS
1432
MASK
1434
CONTROL VECTOR
NEXT POINTER
1436
PRIORITY ENCODE
1438
ROM
1404

FIG. 14

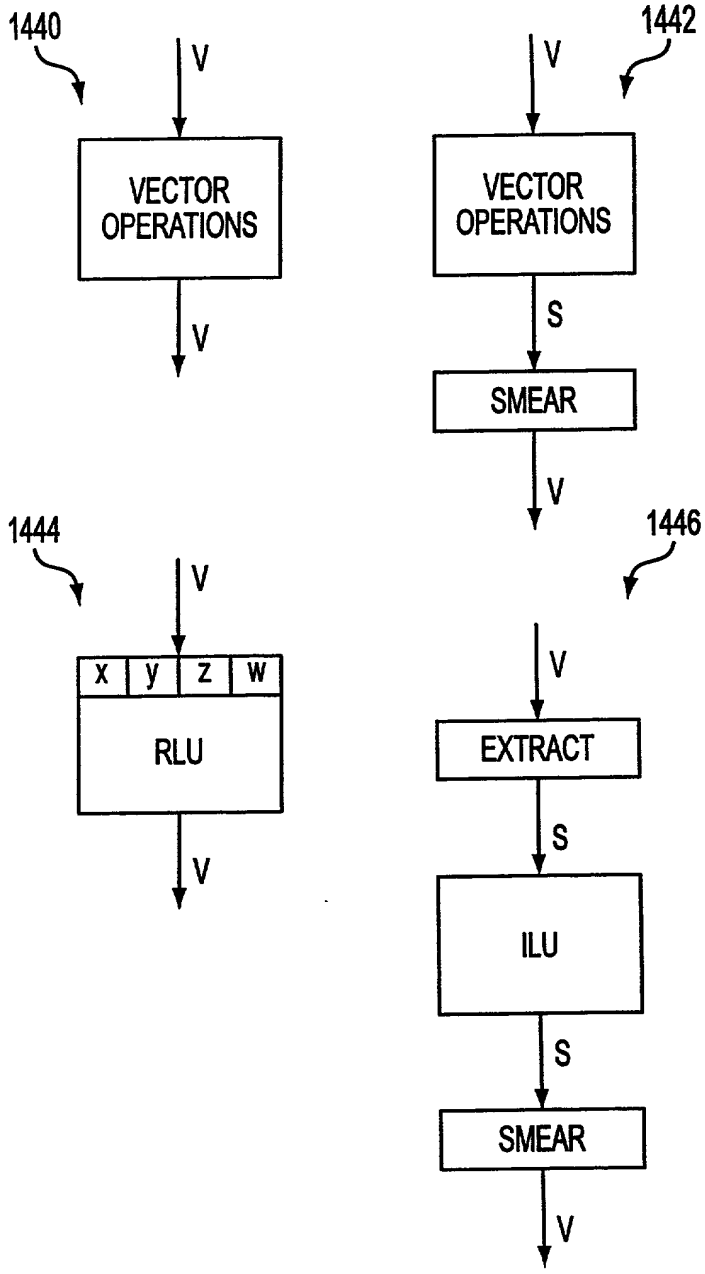
1440
V
VECTOR OPERATIONS
V
1442
V
VECTOR OPERATIONS
S
SMEAR
V
1444
V
x
y
z
w
RLU
V
1446
V
EXTRACT
S
ILU
S
SMEAR
V

FIG. 14A

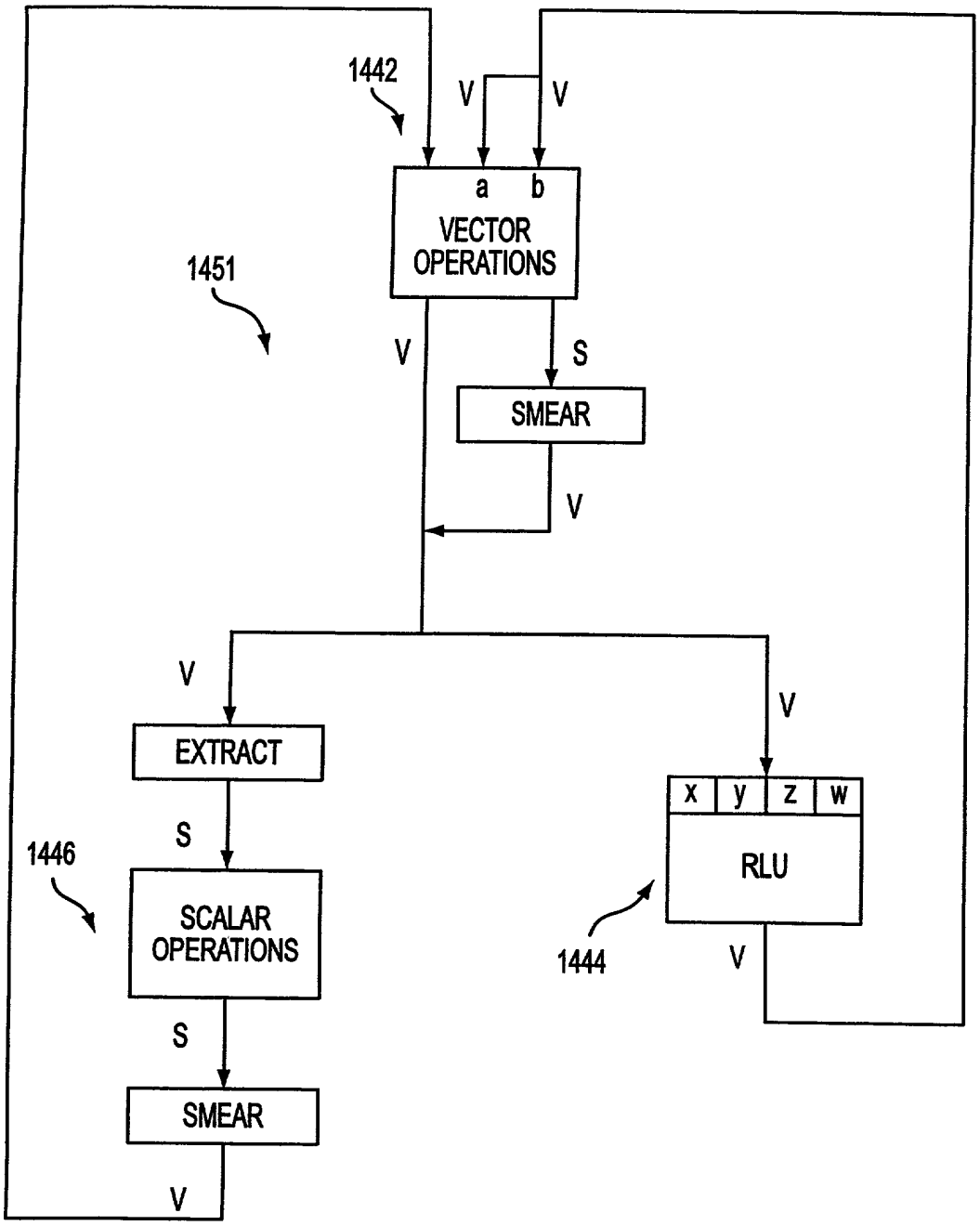
1442
V
V
a
b
VECTOR OPERATIONS
1451
V
S
SMEAR
V
V
V
EXTRACT
S
1446
SCALAR OPERATIONS
S
SMEAR
V
x
y
z
w
RLU
1444
V

FIG. 14B

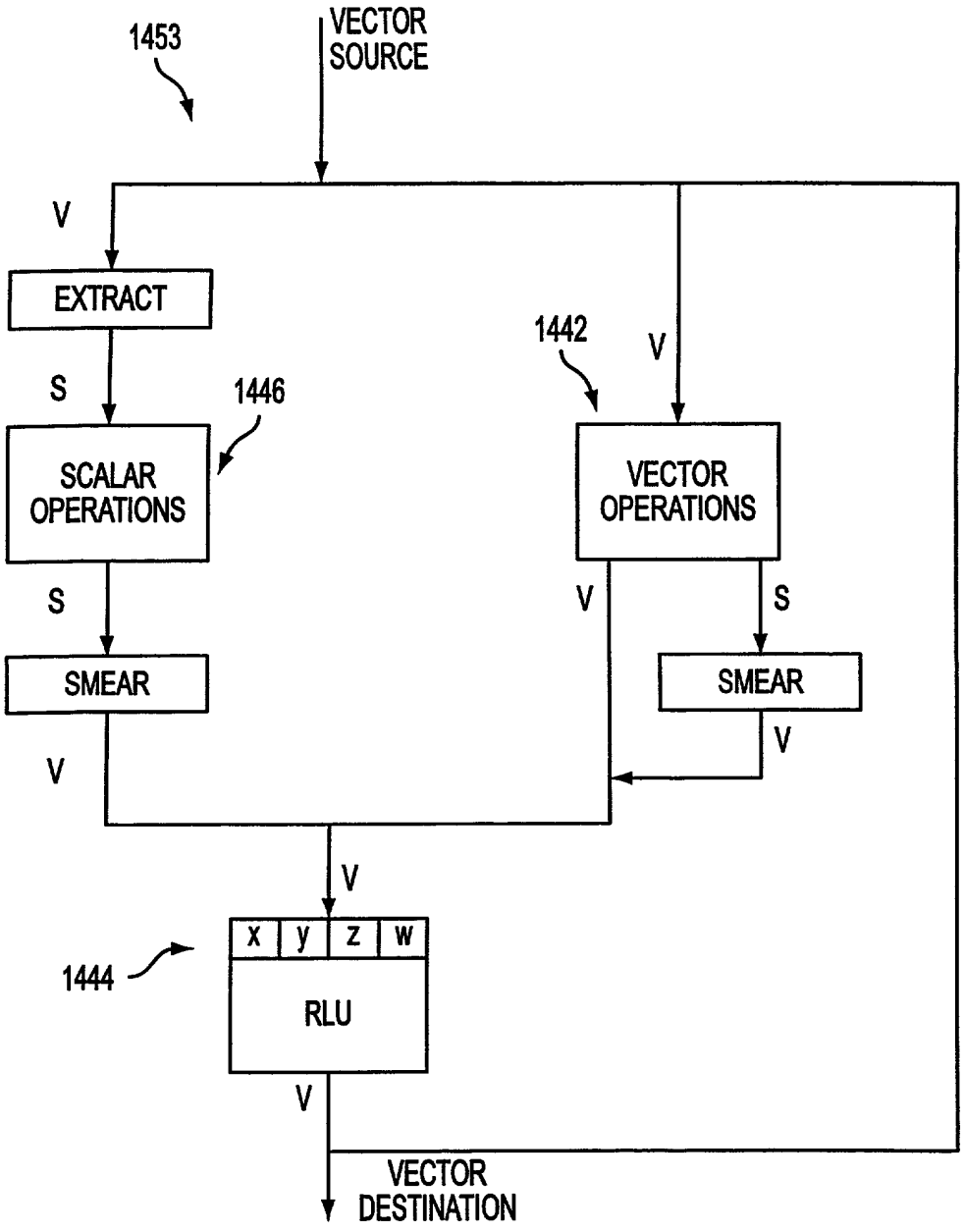
1453
VECTOR SOURCE
V
EXTRACT
S
1446
SCALAR OPERATIONS
S
SMEAR
V
1442
V
VECTOR OPERATIONS
V
S
SMEAR
V
V
1444
x
y
z
w
RLU
V
VECTOR DESTINATION

FIG. 14C

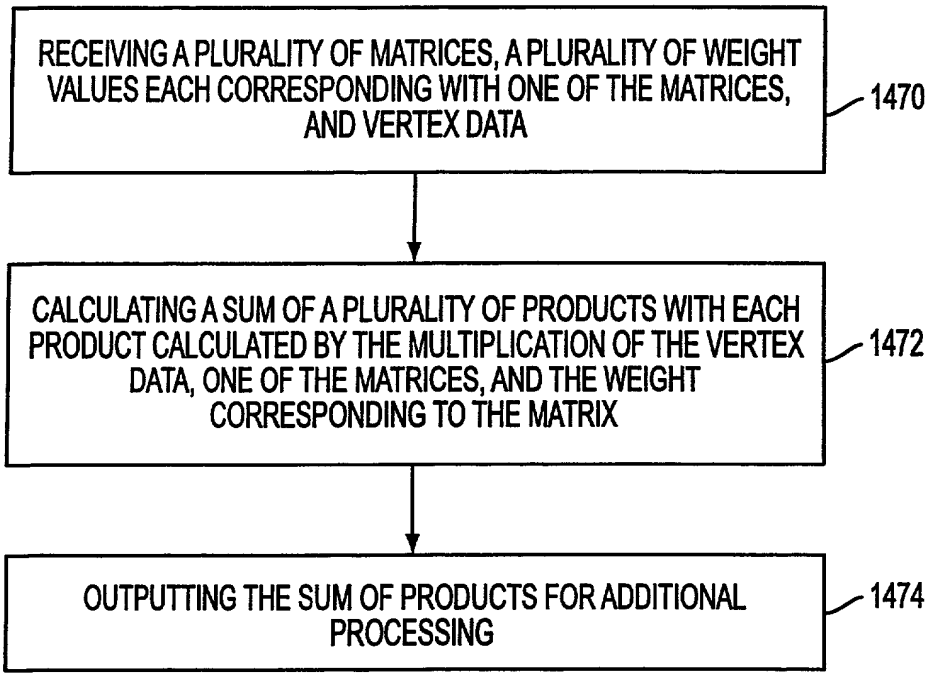
RECEIVING A PLURALITY OF MATRICES, A PLURALITY OF WEIGHT VALUES EACH CORRESPONDING WITH ONE OF THE MATRICES, AND VERTEX DATA
1470
CALCULATING A SUM OF A PLURALITY OF PRODUCTS WITH EACH PRODUCT CALCULATED BY THE MULTIPLICATION OF THE VERTEX DATA, ONE OF THE MATRICES, AND THE WEIGHT CORRESPONDING TO THE MATRIX
1472
OUTPUTTING THE SUM OF PRODUCTS FOR ADDITIONAL PROCESSING
1474

FIG. 14D

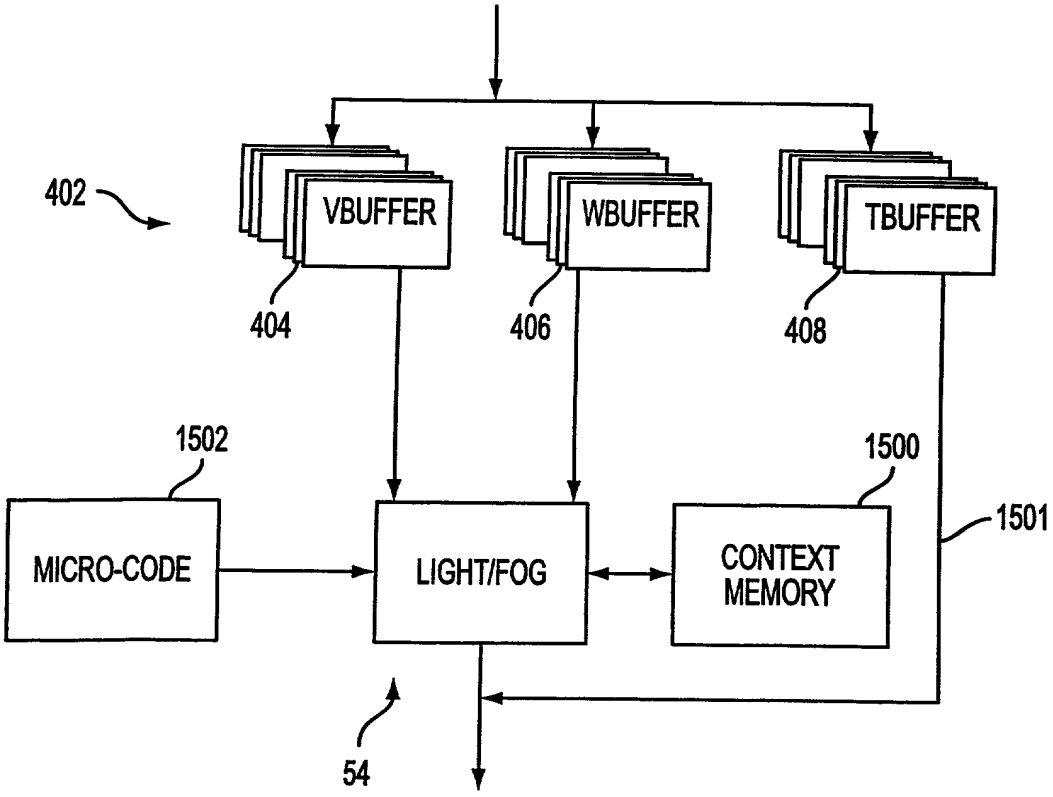
402
VBUFFER
WBUFFER
TBUFFER
404
406
408
1502
1500
1501
MICRO-CODE
LIGHT/FOG
CONTEXT MEMORY
54

FIG. 15

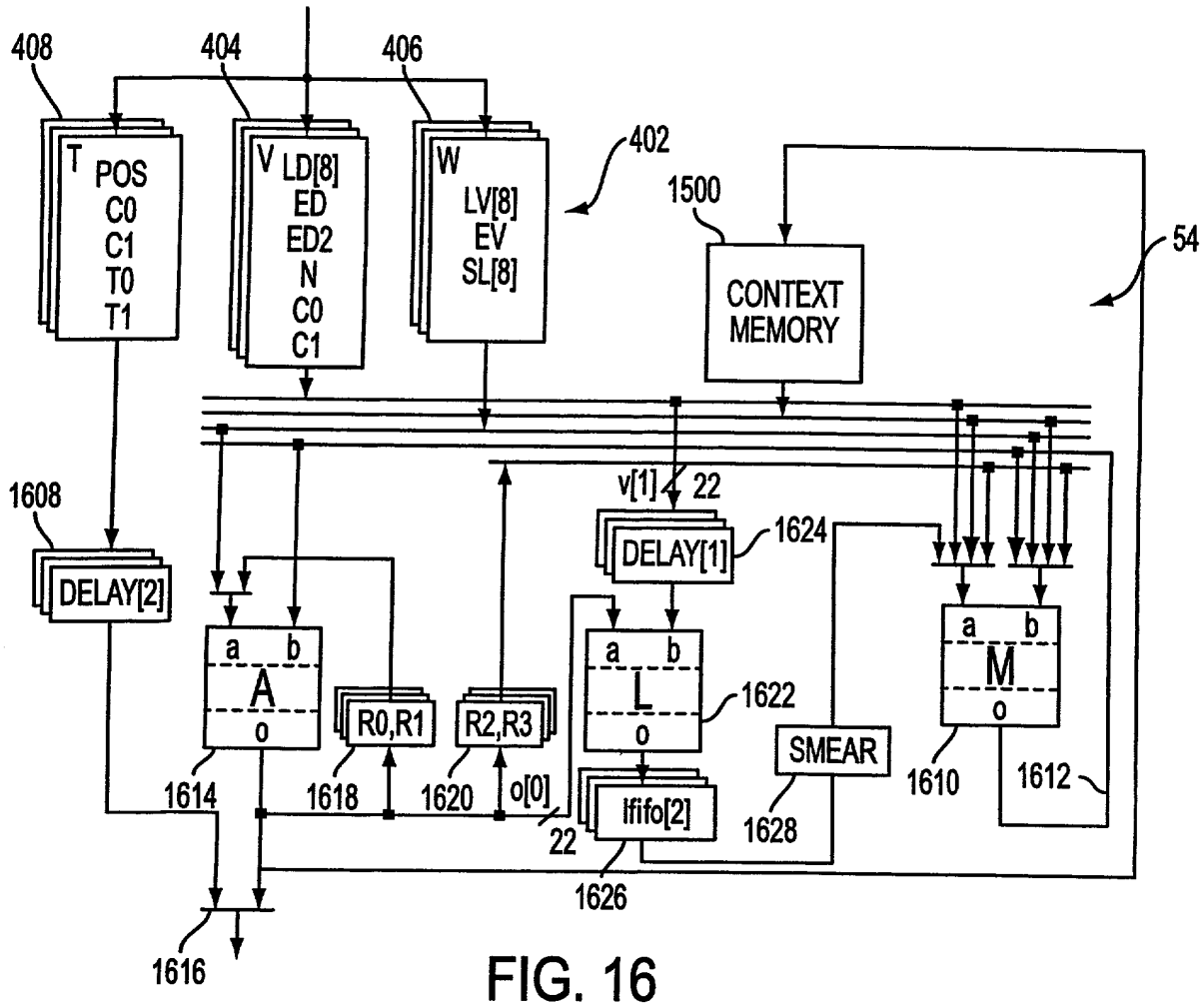
408
404
406
T
POS
C0
C1
T0
T1
V
LD[8]
ED
ED2
N
C0
C1
W
LV[8]
EV
SL[8]
402
1500
CONTEXT MEMORY
54
1608
DELAY[2]
v[1]
22
DELAY[1]
1624
a
b
A
o
R0,R1
R2,R3
L
1622
M
SMEAR
1614
1618
1620
o[0]
22
lfifo[2]
1628
1610
1612
1626
1616

FIG. 16

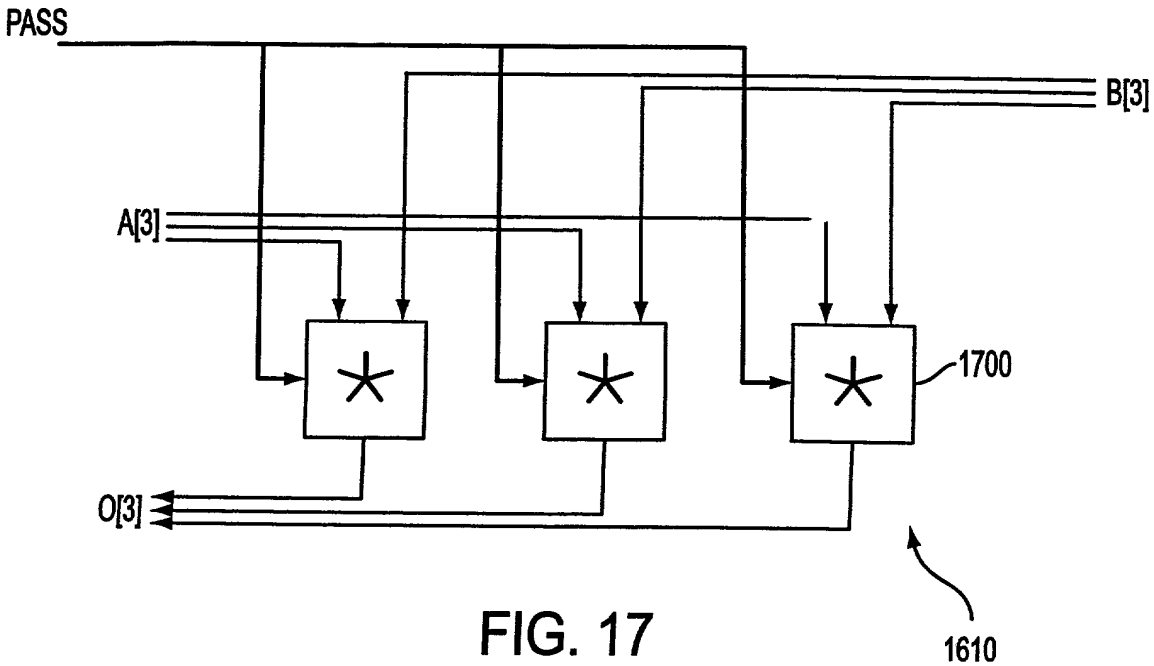
PASS
B[3]
A[3]
1700
O[3]
1610

FIG. 17

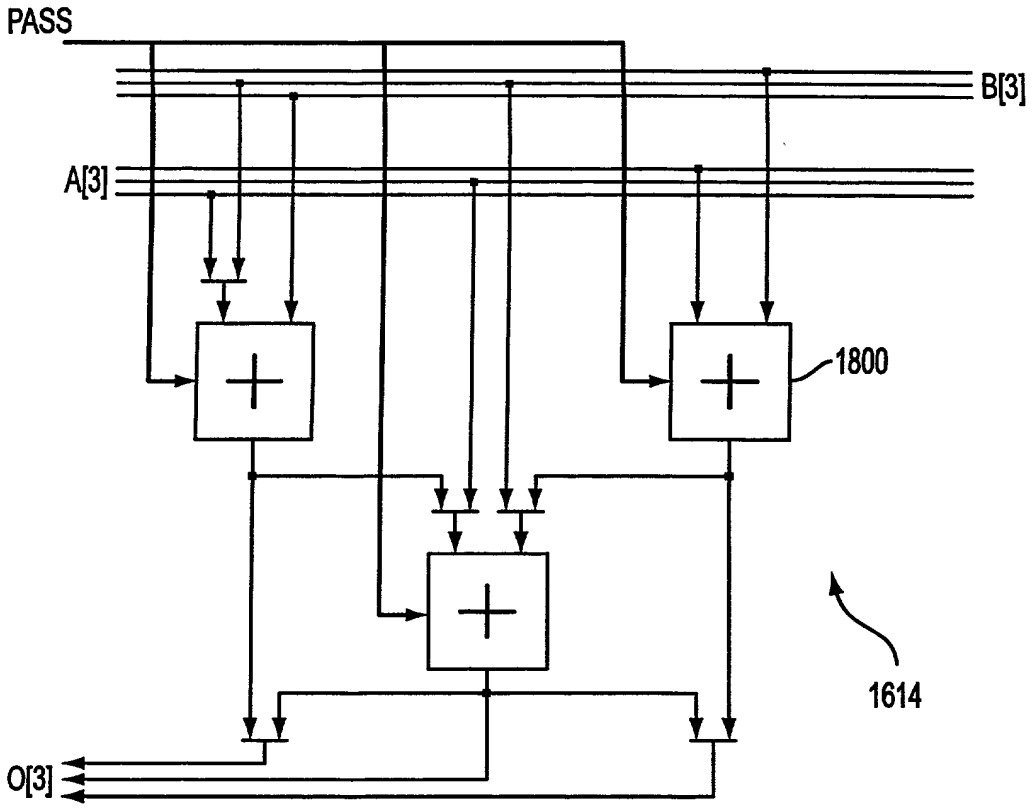
PASS
B[3]
A[3]
1800
1614
O[3]

FIG. 18

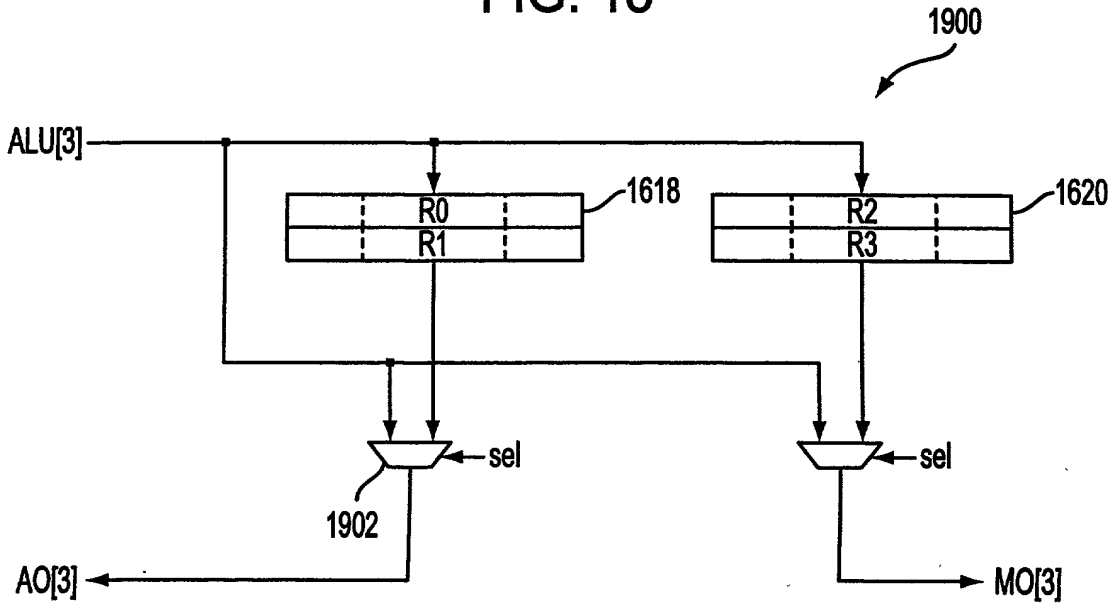
1900
ALU[3]
R0
R1
1618
R2
R3
1620
sel
sel
1902
AO[3]
MO[3]

FIG. 19

PATENT APPLICATION

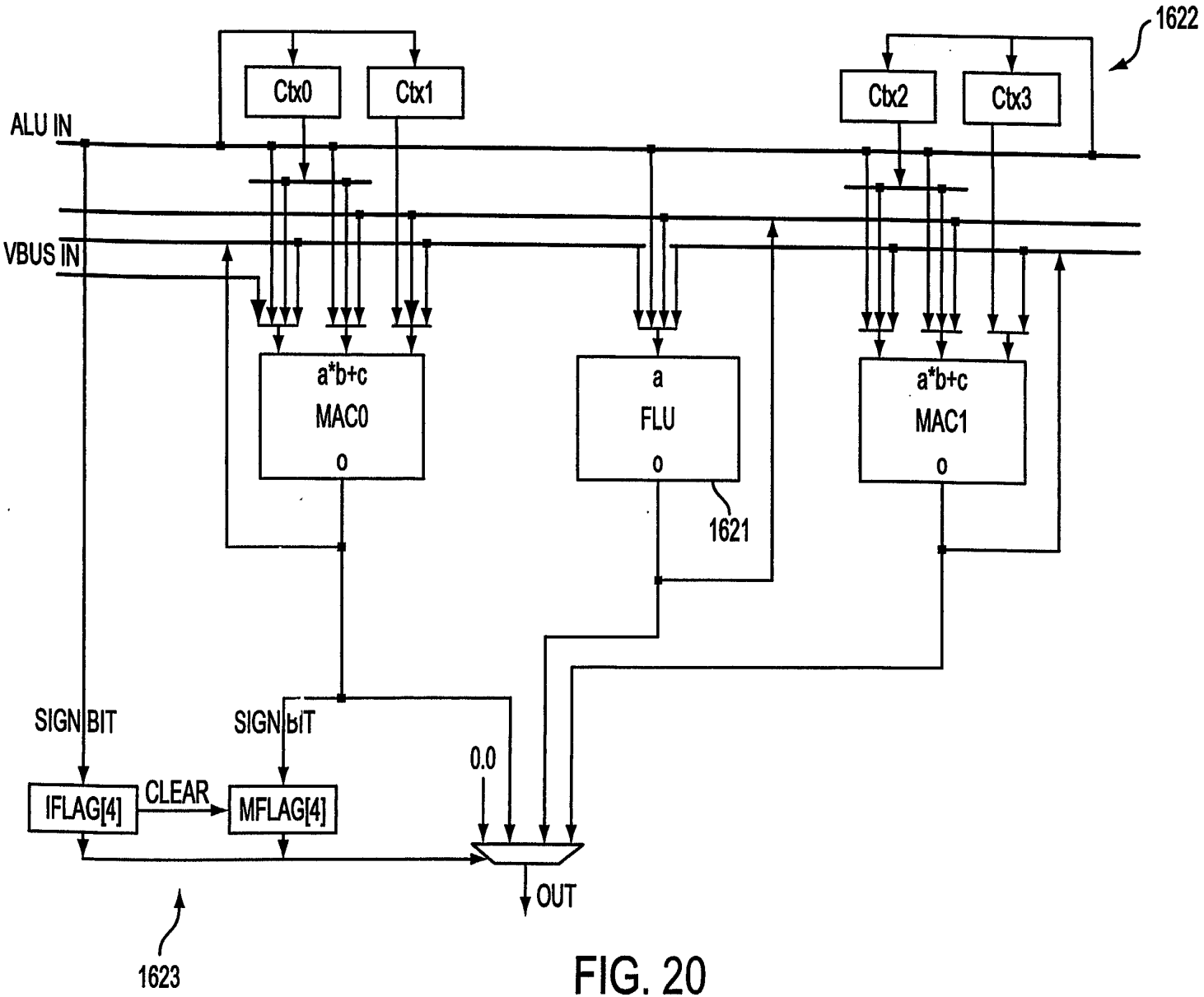


FIG. 20

| NAME | REGISTER | DESCRIPTION |
|---|---|---|
| Z | IFLAG | CLEAR FLAG. SETS IFLAG AND MFLAG TO 0. |
| C | IFLAG | SPOTLIGHT CONE FLAG. SET IF VERTEX IS OUTSIDE SPOTLIGHT CONE. |
| S | IFLAG | SPECULAR2 FLAG. SET IF SPECULAR CONTRIBUTION IS NEGATIVE. |
| D | IFLAG | DIFFUSE FLAG. SET IF DIFFUSE TERM IS NEGATIVE. |
| | MFLAG | |
| U | MFLAG | SPOTLIGHT CONE ATTENUATION FLAG. SET IF SPOTLIGHT CONE ATTENUATION CONTRIBUTION IS NEGATIVE. |
| T | MFLAG | SPECULAR FLAG. SET IF SPECULAR CONTRIBUTION IS NEGATIVE. |
| R | MFLAG | RANGE FLAG. SET IF VERTEX IS TOO FAR AWAY FROM THE LIGHT. |

FIG. 21

| MICROCODE FIELD | BITS | LOCATION | DELAY | DESCRIPTION |
|---|---|---|---|---|
| oa | 3 | 0: 2 | 2 | OUTPUT ADDRESS |
| rwe | 1 | 3 | 2 | RLU WRITE ENABLE |
| rwa | 2 | 4: 5 | 2 | RLU WRITE ADDRESS |
| R23 | 1 | 6 | 0 | RLU (MLU) READ ADDRESS |
| R01 | 1 | 7 | 1 | RLU (ALU) READ ADDRESS |
| aia | 1 | 8 | 1 | ALU INPUT A MUX |
| alu | 2 | 9:10 | 1 | ALU OPERATION |
| mib | 2 | 11:12 | 0 | MLU INPUT B MUX |
| mia | 2 | 13:14 | 0 | MLU INPUT A MUX |
| mlu | 2 | 15:16 | 0 | MLU OPERATION |
| mwa | 5 | 17:21 | 0 | MLU WBUFFER READ ADDRESS |
| awa | 5 | 22:26 | 1 | ALU WBUFFER READ ADDRESS |
| va | 4 | 27:30 | 0 | VBUFFER READ ADDRESS |
| os | 2 | 31:32 | 2 | LLU OUTPUT ADDRESS |
| frm | 6 | 33:38 | 2 | FLAG REGISTER MASK |
| mfe | 1 | 39 | 2 | MFLAG WRITE ENABLE |
| mfa | 2 | 40:41 | 2 | MFLAG WRITE ADDRESS |
| ife | 1 | 42 | 2 | IFLAG WRITE ENABLE |
| ifa | 2 | 43:44 | 2 | IFLAG WRITE ADDRESS |
| fia | 2 | 45:46 | 2 | FLU INPUT A MUX |
| flu | 3 | 47:49 | 2 | FLU OPERATION |
| M1c | 1 | 50 | 2 | MAC1 INPUT C MUX |
| M1b | 2 | 51:52 | 2 | MAC1 INPUT B MUX |
| M1a | 2 | 53:54 | 2 | MAC1 INPUT A MUX |
| M0c | 2 | 55:56 | 2 | MAC0 INPUT C MUX |
| M0b | 2 | 57:58 | 2 | MAC0 INPUT B MUX |
| M0a | 2 | 59:60 | 2 | MAC0 INPUT A MUX |
| ce | 3 | 61:63 | 0,2 | CONTEXT MEMORY READ/WRITE ENABLE |
| ca | 6 | 64:69 | 0,2 | CONTEXT MEMORY ADDRESS |
| C3a | 4 | 70:73 | 2 | CONTEXT3 MEMORY ADDRESS |
| C2a | 4 | 74:77 | 2 | CONTEXT2 MEMORY ADDRESS |
| C1a | 5 | 78:82 | 2 | CONTEXT1 MEMORY ADDRESS |
| C0a | 2 | 83:84 | 2 | CONTEXT0 MEMORY ADDRESS |

FIG. 22

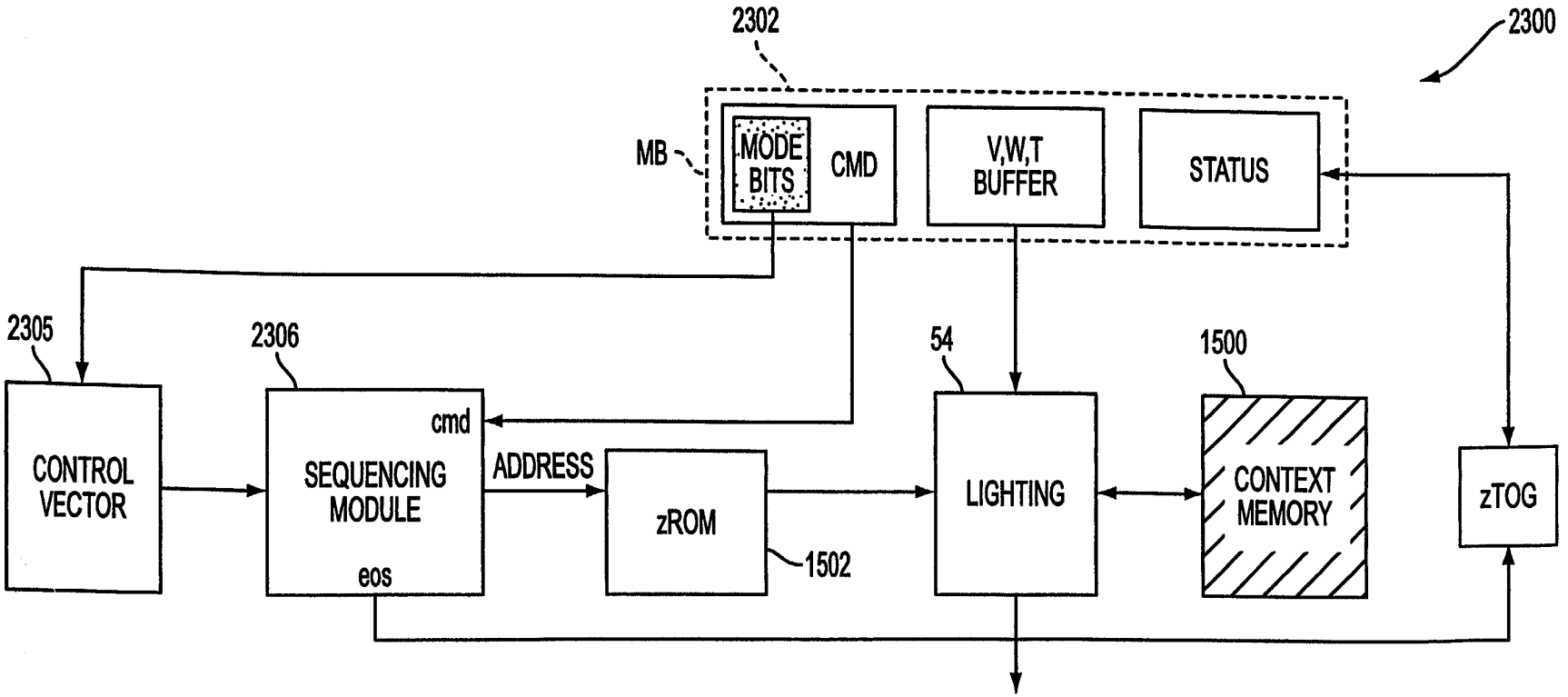
2302
2300
MB
MODE BITS
CMD
V,W,T BUFFER
STATUS
2305
2306
54
1500
CONTROL VECTOR
cmd
SEQUENCING MODULE
eos
ADDRESS
zROM
1502
LIGHTING
CONTEXT MEMORY
zTOG

FIG. 23

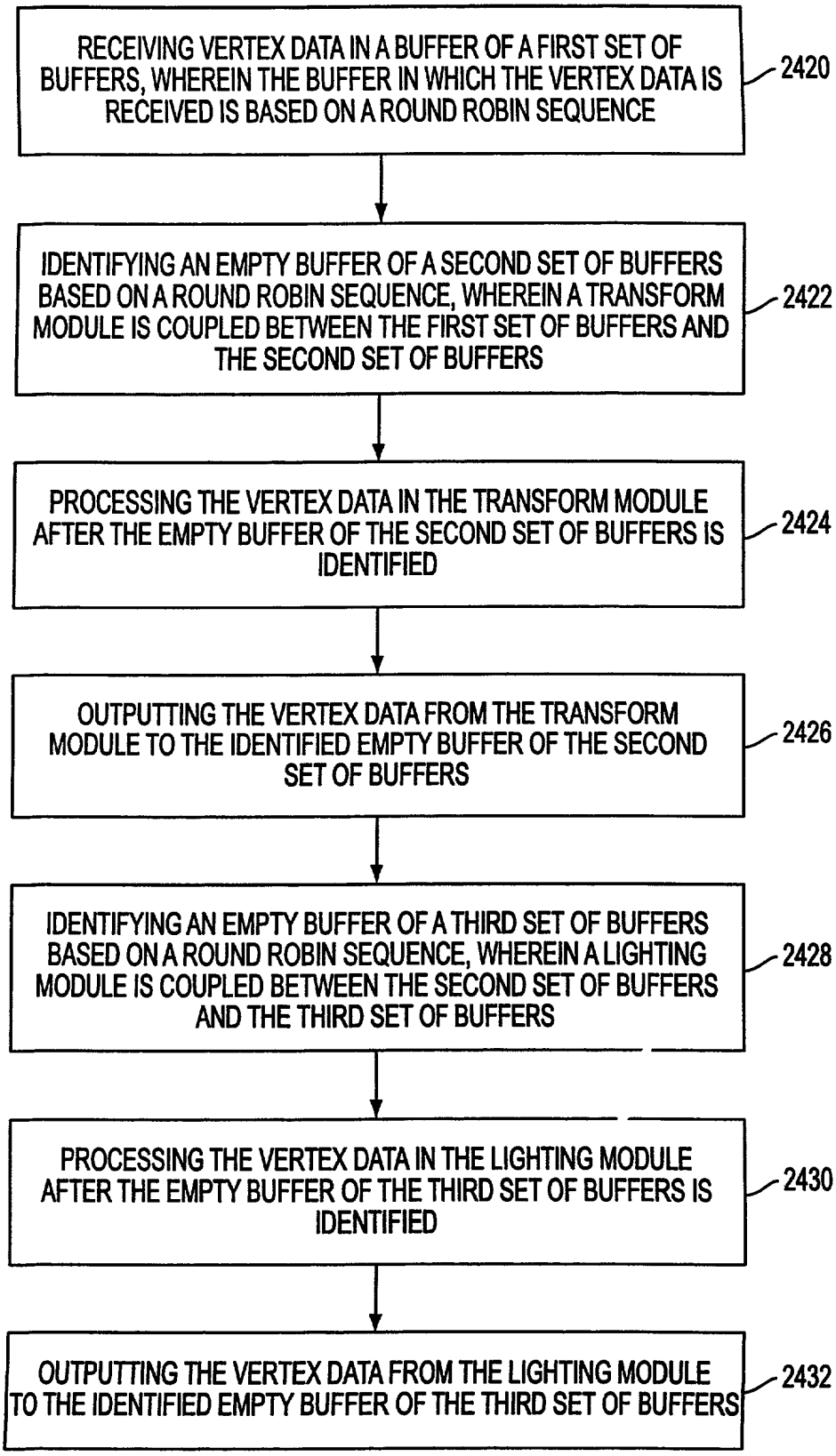
RECEIVING VERTEX DATA IN A BUFFER OF A FIRST SET OF BUFFERS, WHEREIN THE BUFFER IN WHICH THE VERTEX DATA IS RECEIVED IS BASED ON A ROUND ROBIN SEQUENCE
2420
IDENTIFYING AN EMPTY BUFFER OF A SECOND SET OF BUFFERS BASED ON A ROUND ROBIN SEQUENCE, WHEREIN A TRANSFORM MODULE IS COUPLED BETWEEN THE FIRST SET OF BUFFERS AND THE SECOND SET OF BUFFERS
2422
PROCESSING THE VERTEX DATA IN THE TRANSFORM MODULE AFTER THE EMPTY BUFFER OF THE SECOND SET OF BUFFERS IS IDENTIFIED
2424
OUTPUTTING THE VERTEX DATA FROM THE TRANSFORM MODULE TO THE IDENTIFIED EMPTY BUFFER OF THE SECOND SET OF BUFFERS
2426
IDENTIFYING AN EMPTY BUFFER OF A THIRD SET OF BUFFERS BASED ON A ROUND ROBIN SEQUENCE, WHEREIN A LIGHTING MODULE IS COUPLED BETWEEN THE SECOND SET OF BUFFERS AND THE THIRD SET OF BUFFERS
2428
PROCESSING THE VERTEX DATA IN THE LIGHTING MODULE AFTER THE EMPTY BUFFER OF THE THIRD SET OF BUFFERS IS IDENTIFIED
2430
OUTPUTTING THE VERTEX DATA FROM THE LIGHTING MODULE TO THE IDENTIFIED EMPTY BUFFER OF THE THIRD SET OF BUFFERS
2432

FIG. 24

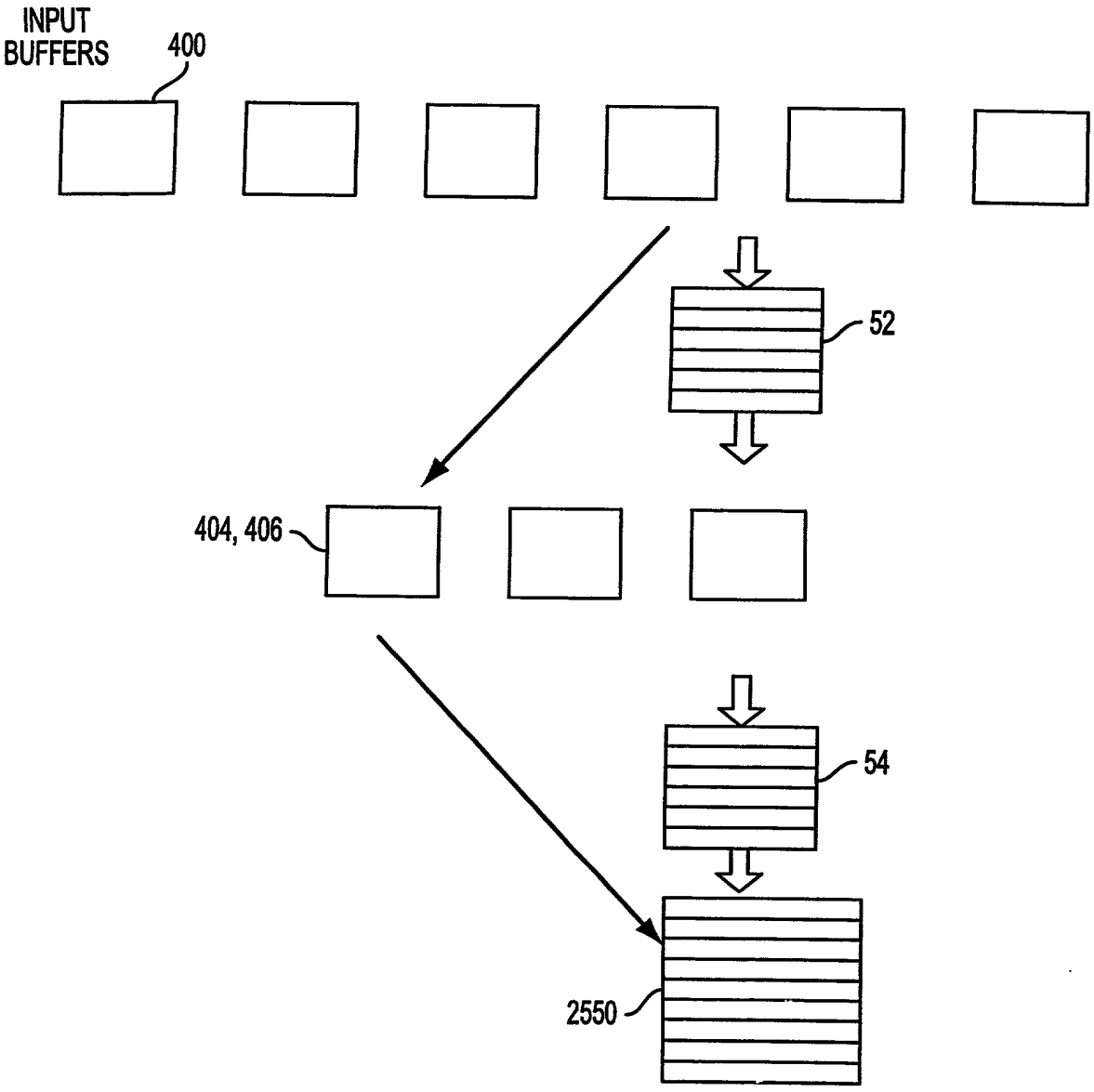


FIG. 25

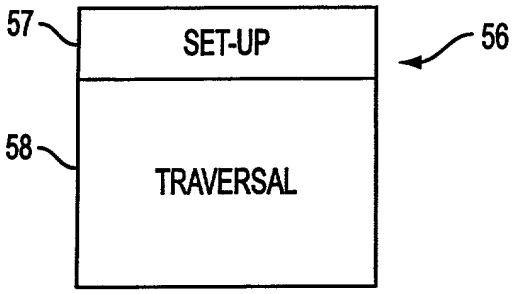


FIG. 25B

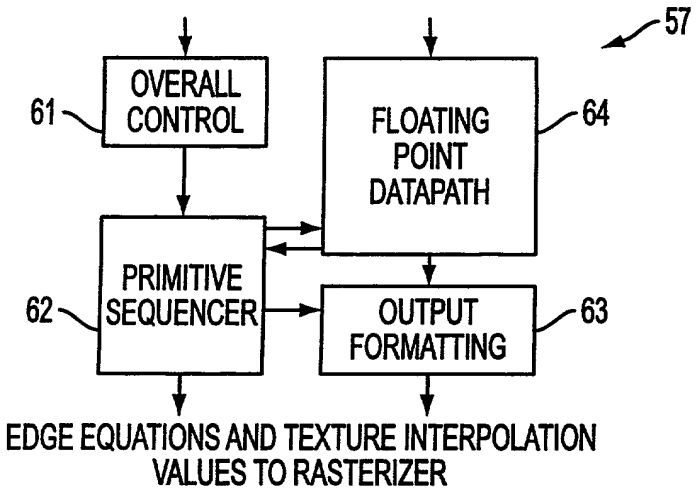


FIG. 26

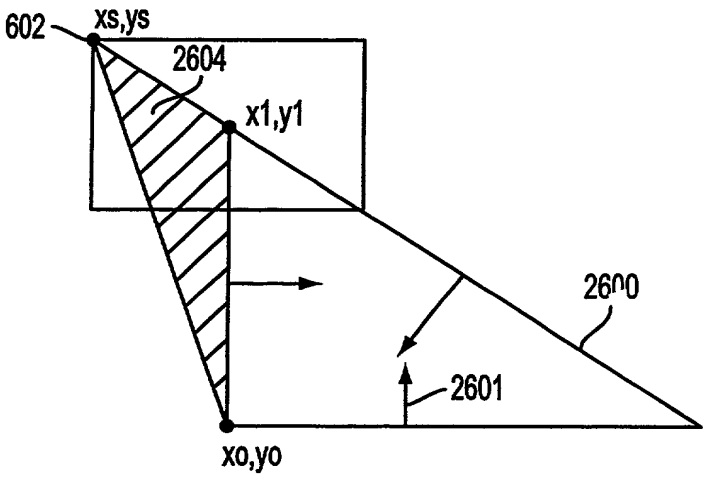


FIG. 26A

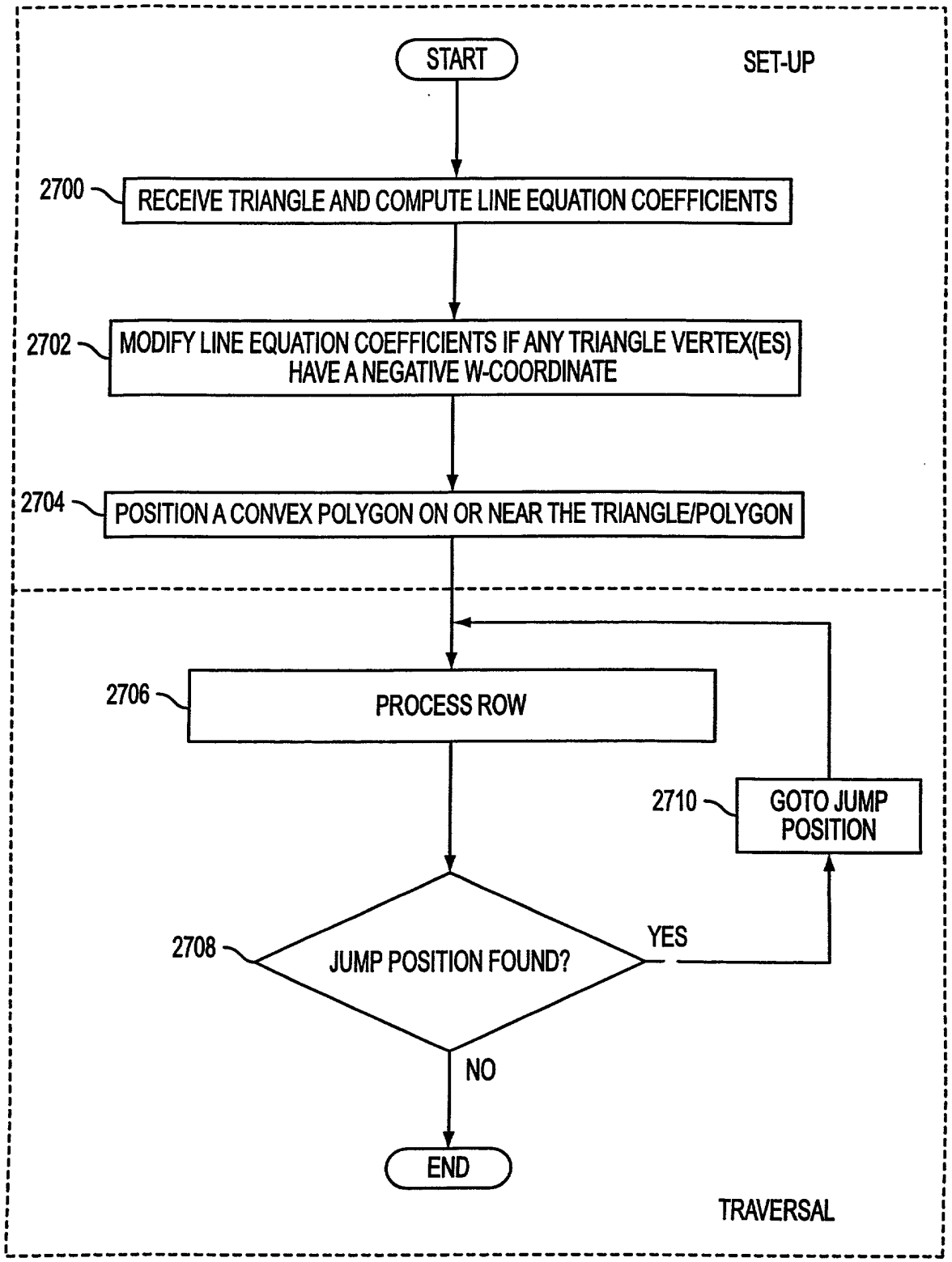
START
SET-UP
2700
RECEIVE TRIANGLE AND COMPUTE LINE EQUATION COEFFICIENTS
2702
MODIFY LINE EQUATION COEFFICIENTS IF ANY TRIANGLE VERTEX(ES) HAVE A NEGATIVE W-COORDINATE
2704
POSITION A CONVEX POLYGON ON OR NEAR THE TRIANGLE/POLYGON
2706
PROCESS ROW
2710
GOTO JUMP POSITION
2708
JUMP POSITION FOUND?
YES
NO
END
TRAVERSAL

FIG. 27

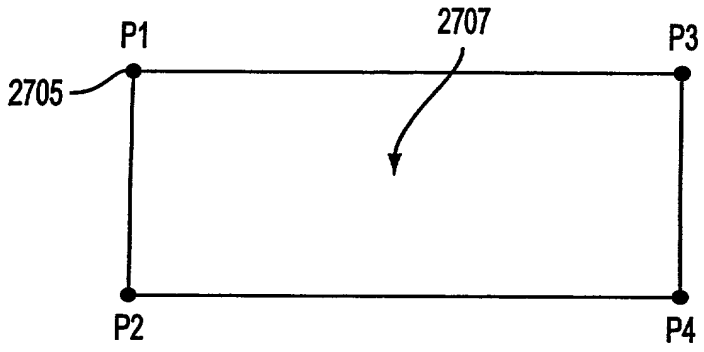


FIG. 27A

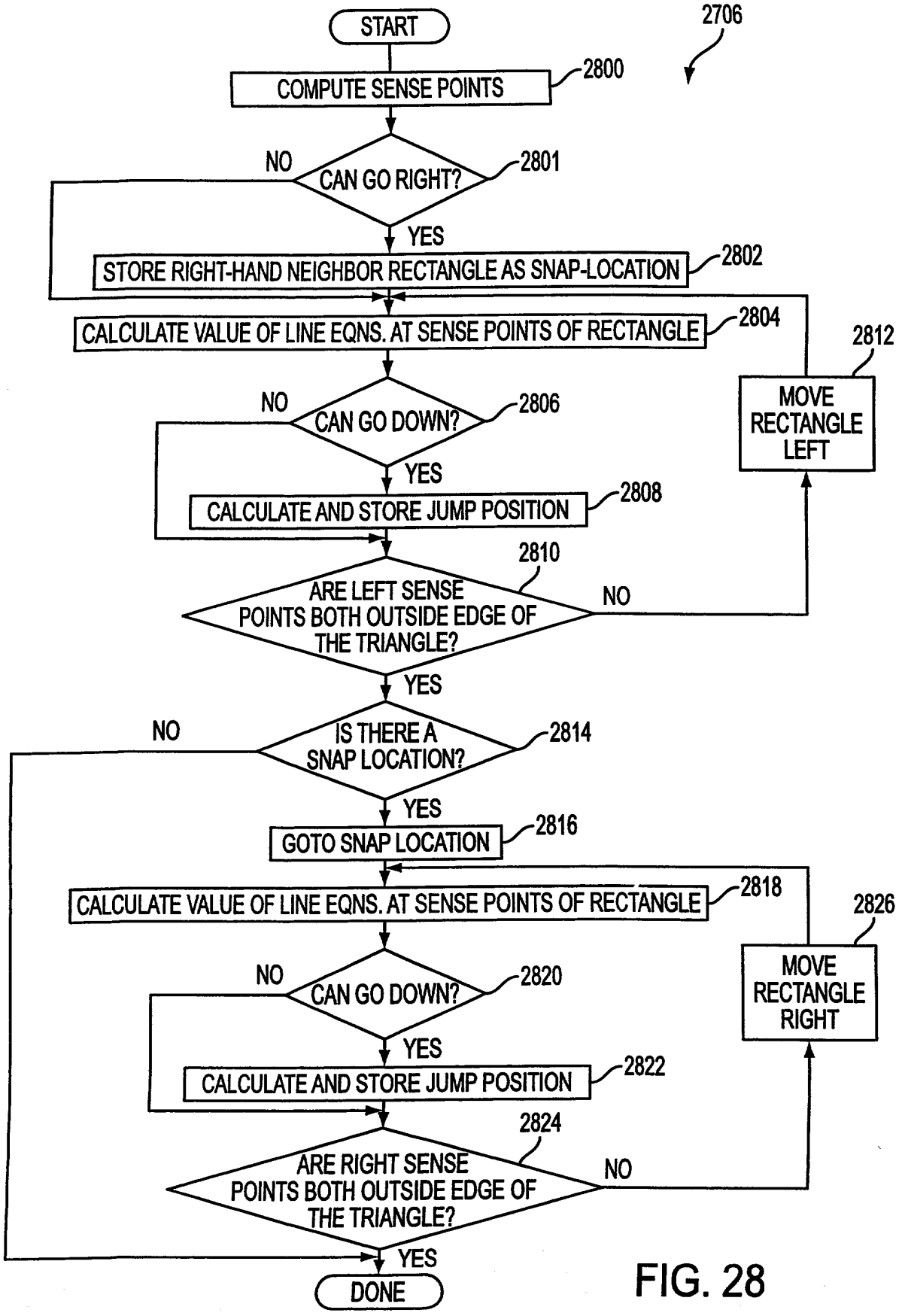
START
2706
COMPUTE SENSE POINTS
2800
NO
CAN GO RIGHT?
2801
YES
STORE RIGHT-HAND NEIGHBOR RECTANGLE AS SNAP-LOCATION
2802
CALCULATE VALUE OF LINE EQNS. AT SENSE POINTS OF RECTANGLE
2804
2812
MOVE RECTANGLE LEFT
NO
CAN GO DOWN?
2806
YES
CALCULATE AND STORE JUMP POSITION
2808
2810
ARE LEFT SENSE POINTS BOTH OUTSIDE EDGE OF THE TRIANGLE?
NO
YES
NO
IS THERE A SNAP LOCATION?
2814
YES
GOTO SNAP LOCATION
2816
CALCULATE VALUE OF LINE EQNS. AT SENSE POINTS OF RECTANGLE
2818
2826
MOVE RECTANGLE RIGHT
NO
CAN GO DOWN?
2820
YES
CALCULATE AND STORE JUMP POSITION
2822
2824
ARE RIGHT SENSE POINTS BOTH OUTSIDE EDGE OF THE TRIANGLE?
NO
YES
DONE

FIG. 28

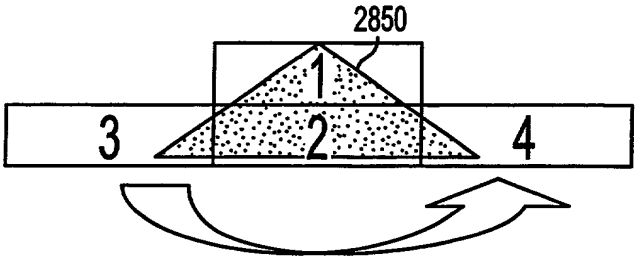


FIG. 28A

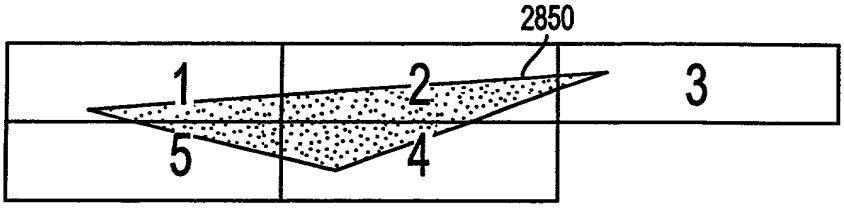


FIG. 28B

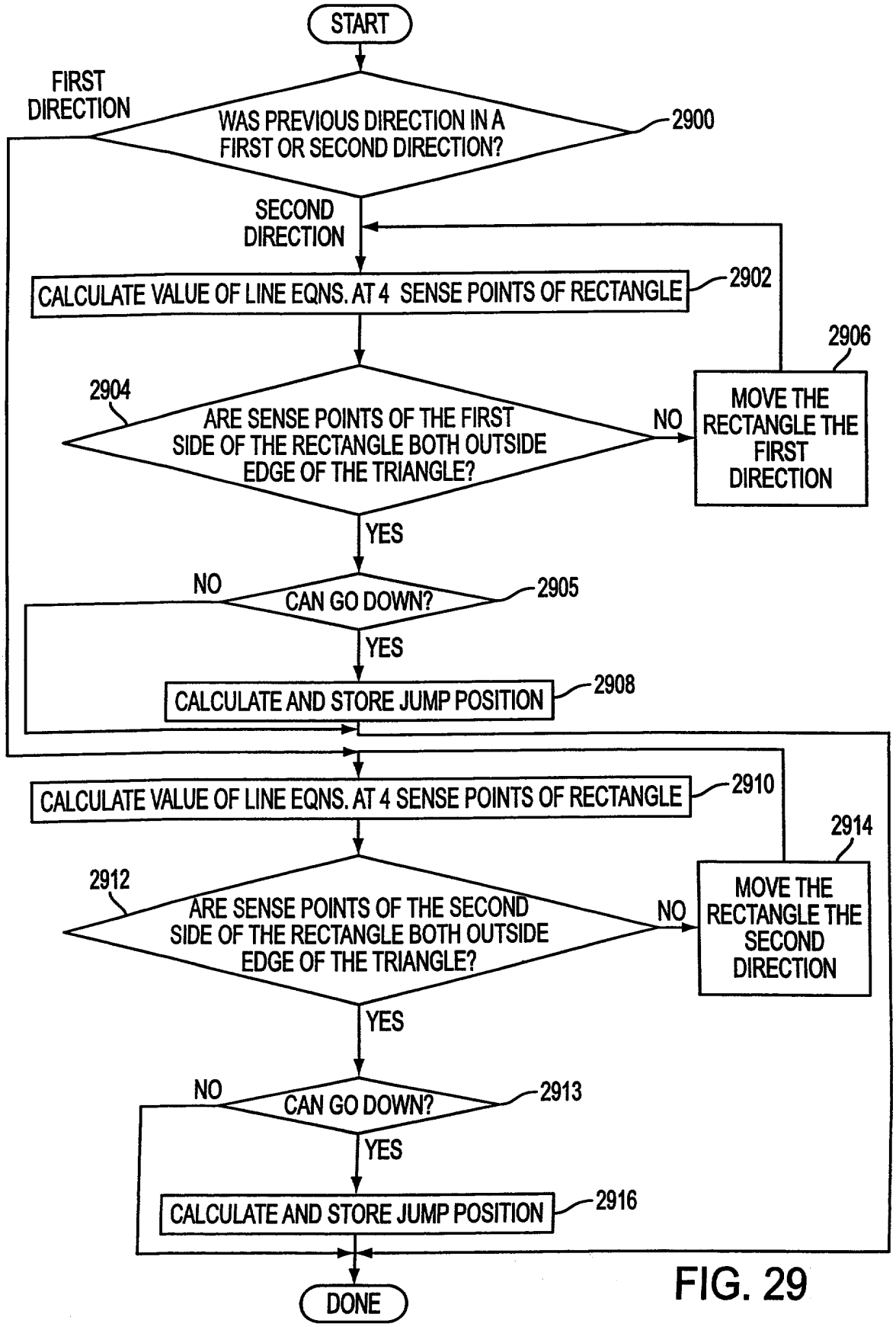
START
FIRST DIRECTION
WAS PREVIOUS DIRECTION IN A FIRST OR SECOND DIRECTION?
2900
SECOND DIRECTION
CALCULATE VALUE OF LINE EQNS. AT 4 SENSE POINTS OF RECTANGLE
2902
2906
2904
ARE SENSE POINTS OF THE FIRST SIDE OF THE RECTANGLE BOTH OUTSIDE EDGE OF THE TRIANGLE?
NO
MOVE THE RECTANGLE THE FIRST DIRECTION
YES
NO
CAN GO DOWN?
2905
YES
CALCULATE AND STORE JUMP POSITION
2908
CALCULATE VALUE OF LINE EQNS. AT 4 SENSE POINTS OF RECTANGLE
2910
2914
2912
ARE SENSE POINTS OF THE SECOND SIDE OF THE RECTANGLE BOTH OUTSIDE EDGE OF THE TRIANGLE?
NO
MOVE THE RECTANGLE THE SECOND DIRECTION
YES
NO
CAN GO DOWN?
2913
YES
CALCULATE AND STORE JUMP POSITION
2916
DONE

FIG. 29

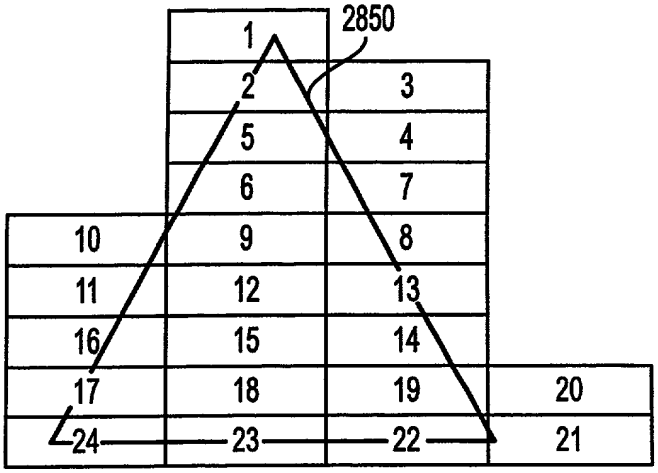


FIG. 29A

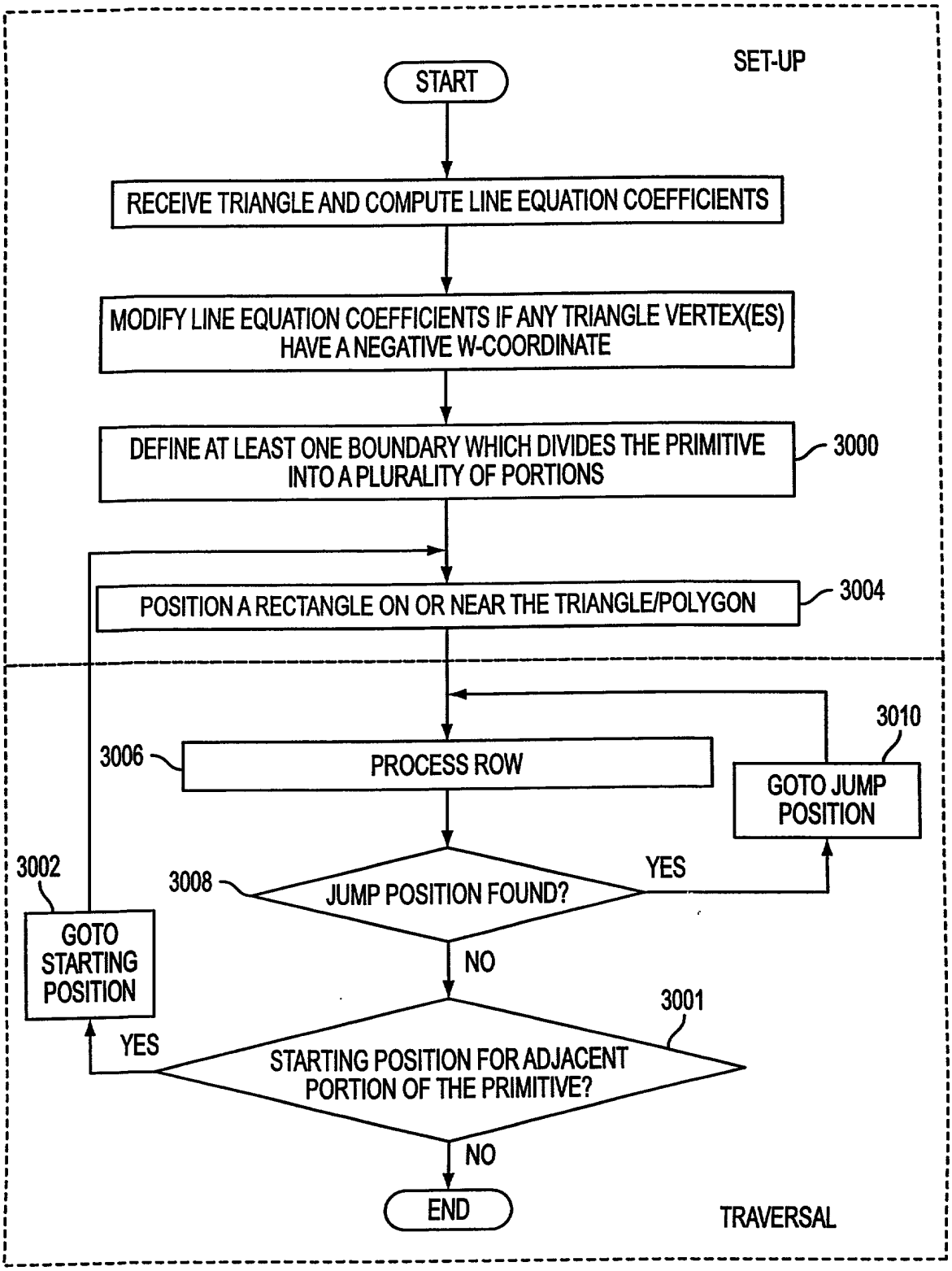
SET-UP
START
RECEIVE TRIANGLE AND COMPUTE LINE EQUATION COEFFICIENTS
MODIFY LINE EQUATION COEFFICIENTS IF ANY TRIANGLE VERTEX(ES) HAVE A NEGATIVE W-COORDINATE
DEFINE AT LEAST ONE BOUNDARY WHICH DIVIDES THE PRIMITIVE INTO A PLURALITY OF PORTIONS
3000
POSITION A RECTANGLE ON OR NEAR THE TRIANGLE/POLYGON
3004
3010
3006
PROCESS ROW
GOTO JUMP POSITION
3002
3008
JUMP POSITION FOUND?
YES
GOTO STARTING POSITION
NO
3001
YES
STARTING POSITION FOR ADJACENT PORTION OF THE PRIMITIVE?
NO
END
TRAVERSAL

FIG. 30

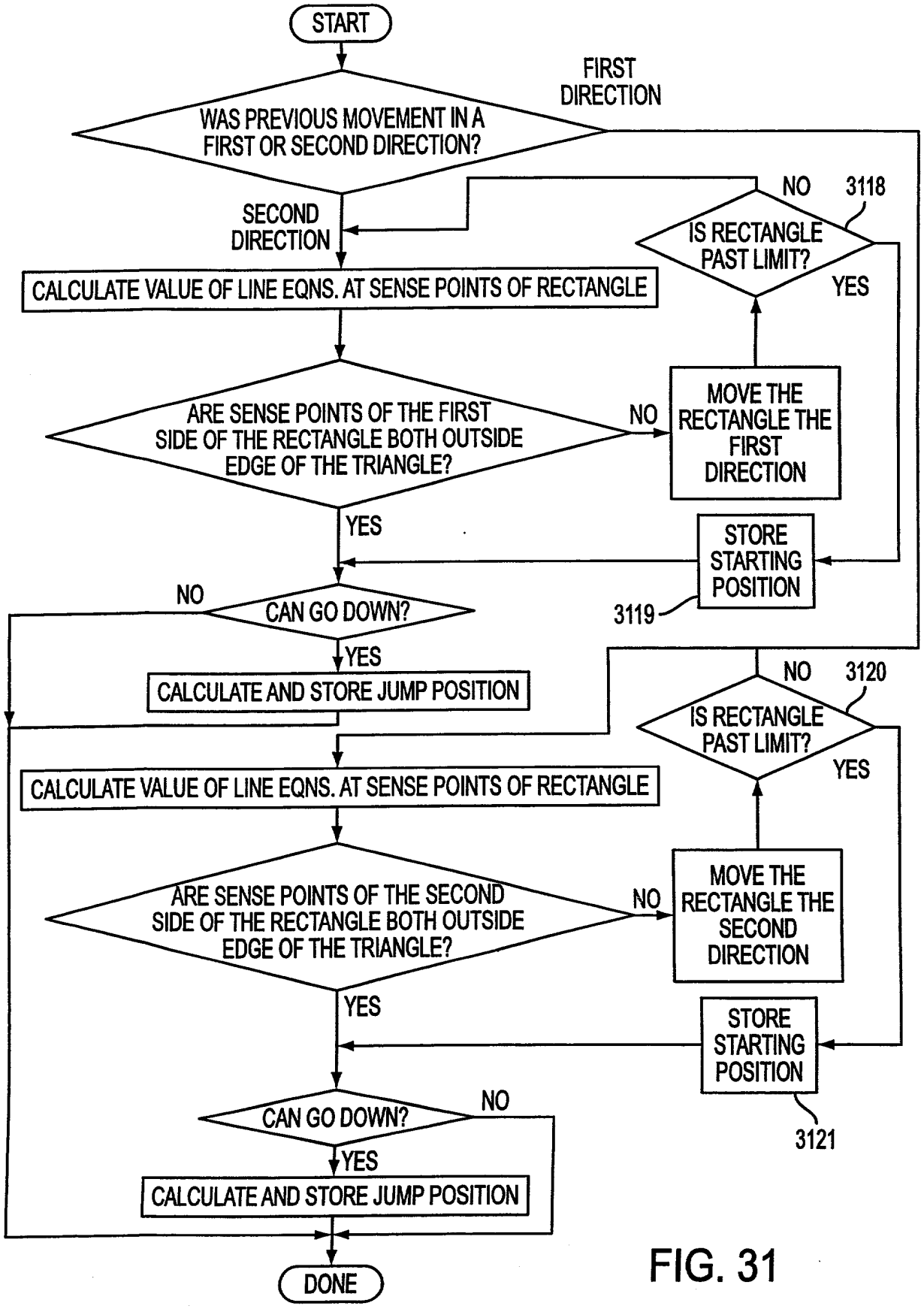
START
WAS PREVIOUS MOVEMENT IN A FIRST OR SECOND DIRECTION?
FIRST DIRECTION
SECOND DIRECTION
CALCULATE VALUE OF LINE EQNS. AT SENSE POINTS OF RECTANGLE
ARE SENSE POINTS OF THE FIRST SIDE OF THE RECTANGLE BOTH OUTSIDE EDGE OF THE TRIANGLE?
NO
MOVE THE RECTANGLE THE FIRST DIRECTION
YES
NO
3118
IS RECTANGLE PAST LIMIT?
YES
STORE STARTING POSITION
3119
NO
CAN GO DOWN?
YES
CALCULATE AND STORE JUMP POSITION
NO
3120
IS RECTANGLE PAST LIMIT?
YES
CALCULATE VALUE OF LINE EQNS. AT SENSE POINTS OF RECTANGLE
ARE SENSE POINTS OF THE SECOND SIDE OF THE RECTANGLE BOTH OUTSIDE EDGE OF THE TRIANGLE?
NO
MOVE THE RECTANGLE THE SECOND DIRECTION
YES
STORE STARTING POSITION
3121
CAN GO DOWN?
NO
YES
CALCULATE AND STORE JUMP POSITION
DONE

FIG. 31

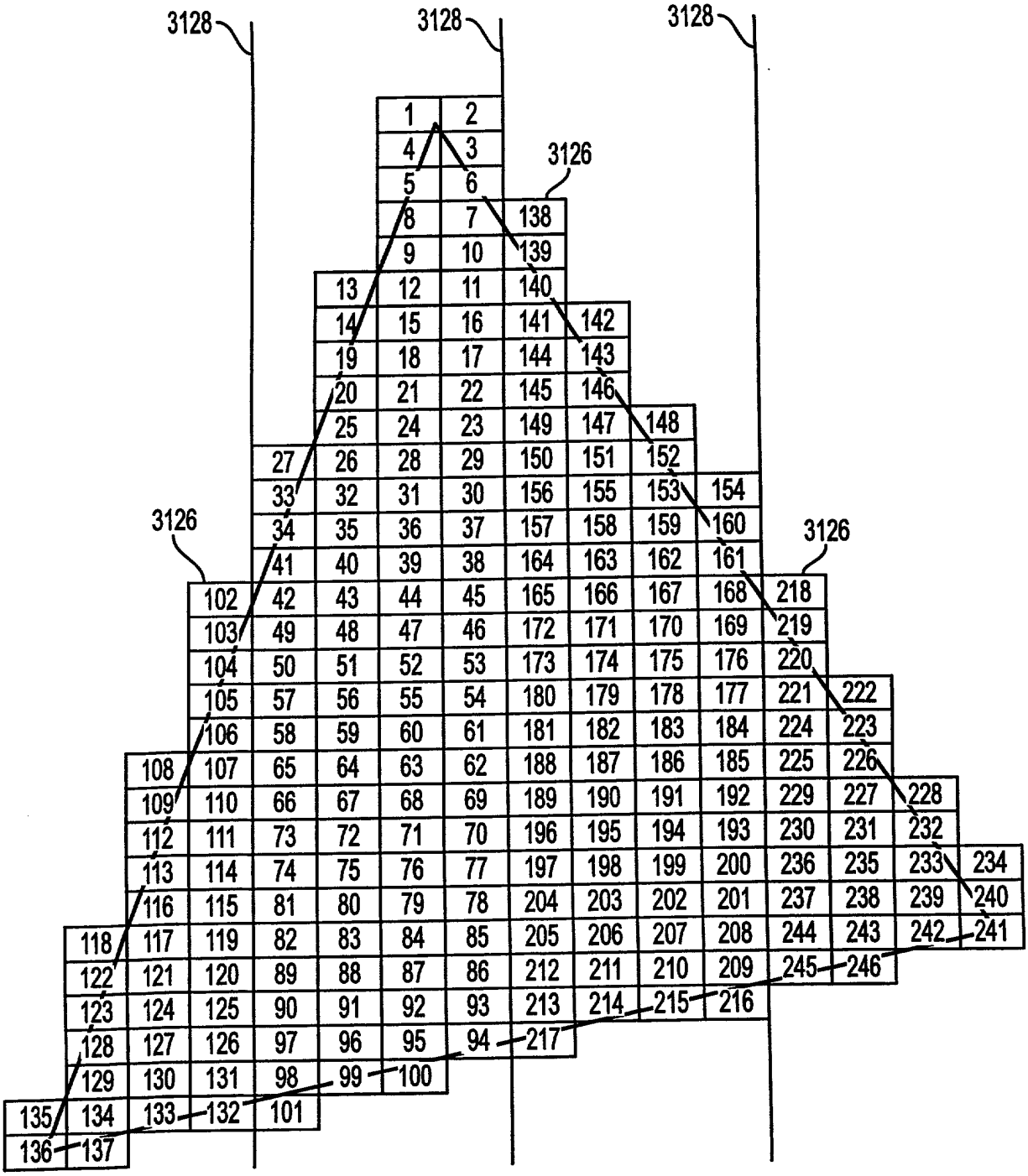
3128
3128
3128
3126
3126
3126
1 2
4 3
5 6
8 7 138
9 10 139
13 12 11 140
14 15 16 141 142
19 18 17 144 143
20 21 22 145 146
25 24 23 149 147 148
27 26 28 29 150 151 152
33 32 31 30 156 155 153 154
34 35 36 37 157 158 159 160
41 40 39 38 164 163 162 161
102 42 43 44 45 165 166 167 168 218
103 49 48 47 46 172 171 170 169 219
104 50 51 52 53 173 174 175 176 220
105 57 56 55 54 180 179 178 177 221 222
106 58 59 60 61 181 182 183 184 224 223
108 107 65 64 63 62 188 187 186 185 225 226
109 110 66 67 68 69 189 190 191 192 229 227 228
112 111 73 72 71 70 196 195 194 193 230 231 232
113 114 74 75 76 77 197 198 199 200 236 235 233 234
116 115 81 80 79 78 204 203 202 201 237 238 239 240
118 117 119 82 83 84 85 205 206 207 208 244 243 242 241
122 121 120 89 88 87 86 212 211 210 209 245 246
123 124 125 90 91 92 93 213 214 215 216
128 127 126 97 96 95 94 217
129 130 131 98 99 100
135 134 133 132 101
136 137

FIG. 31A

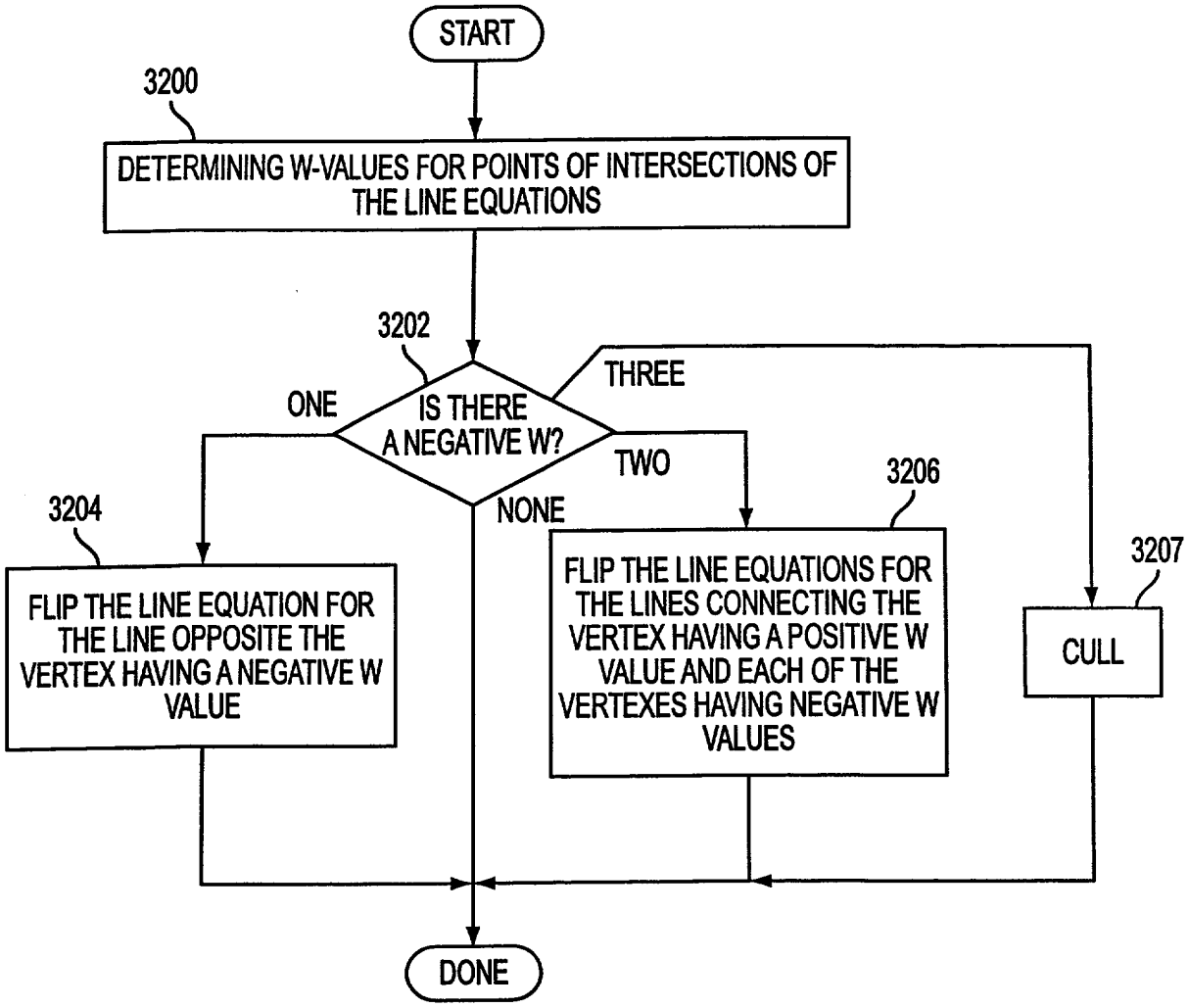
START
3200
DETERMINING W-VALUES FOR POINTS OF INTERSECTIONS OF THE LINE EQUATIONS
3202
IS THERE A NEGATIVE W?
ONE
TWO
THREE
NONE
3204
FLIP THE LINE EQUATION FOR THE LINE OPPOSITE THE VERTEX HAVING A NEGATIVE W VALUE
3206
FLIP THE LINE EQUATIONS FOR THE LINES CONNECTING THE VERTEX HAVING A POSITIVE W VALUE AND EACH OF THE VERTEXES HAVING NEGATIVE W VALUES
3207
CULL
DONE

FIG. 32

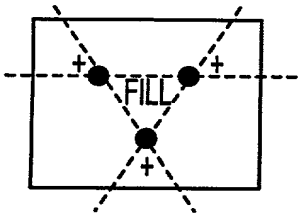


FIG. 32A

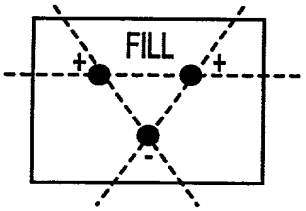


FIG. 32B

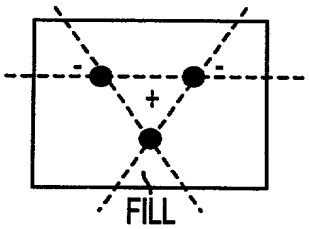


FIG. 32C